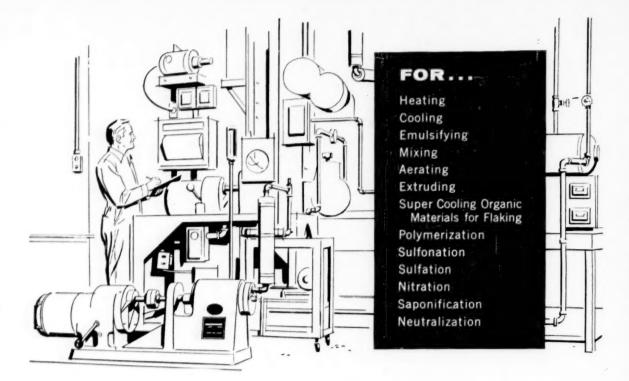
an old trade or a new profession

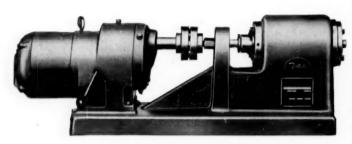
WHAT'S A COST ENGINEER? NEW DATA ON PIPE COSTS. THE ART OF CHANGING JOES.

-PAGE THREE



PILOT PLANT UNIT

helps you discover improved processing with high-speed heat transfer



VOTATOR HEAT TRANSFER PILOT PLANT UNIT This 3" size has heat transfer surface of 0.7 square feet Girdler announces a line of VOTATOR* Heat Transfer Units for laboratory or pilot plant work . . . to help you apply highly efficient continuous processing to your products. These scraped surface heat exchangers or continuous pressure reactors feature:

- High rate of heat transfer
- Working pressures to 500 psi
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Available in sizes from 0.7 sq. ft. to 60.0 sq. ft. heat transfer surface area. For liquid or vapor jacket media. Full details in Bulletin V217, free on request.

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JOHN R. CALLAHAM, Editor-in-Chief

To Serve the Whole Engineer

CE serves the engineer concerned with chemical operations . . . whatever his function, wherever he may be. What does this mean?

The chemical engineer's job is to convert chemical and other scientific knowledge to practical and profitable use.

It is his responsibility, therefore, to economically develop, design, build, operate, maintain, service and manage all types of chemical

operations.

In doing this, the engineer works within five broad areas, all of which overlap to some extent: (1) Research and development, (2) design and construction, (3) production and plant operations, (4) markets, sales and services, (5) administration.

Since this concept stresses function rather than degree or job title, it includes those engineers mechanical, metallurgical, electrical or other degrees who're primarily concerned with chemical operations, thus function as chemical engineers.

Most chemical operations are carried out in the familiar chemical process industries; chemical engineers are therefore concentrated

in these industries.

There are many chemical engineers, however, in other industries that also have chemical operations as well as in those businesses and professions that serve all processing industries. "service" group includes engineering and construction firms, equipment manufacturers, raw material suppliers, consultants, research organizations, engineering schools.

By serving all engineers concerned with chemical operations . . . whatever their function, wherever they are . . . CE blankets the chemical process industries, penetrates deeply into all industry.



GUIDED TOUR



The lowdown on cost engineering

All engineers in all functions have a piece of "must" reading in this month's feature article on cost engineering. We've defined this rapidly growing field and related it to all engineering functions. See how you can sharpen up your cost estimating and cost control to cope with today's narrowing profit margins. (p. 237)



Synthetic terpenes hit the news

Engineering know-how has cracked another special stronghold of natural products. Now terpene chemicals are being turned out as raw materials for a multitude of consumer-oriented derivatives. (p. 148)



Smashing one metering bottleneck

You can extend rotameter ranges, if process changes demand, by a simple expedient.

Chemical

Developments in Chemical Engineering

JULY 1957

GUIDED TOUR

Step-by-step directions show how to calculate size of a bypass orifice and calibrate for accurate results. (p. 240)



New way to estimate pipe costs

Try this new "diameter inch" way of estimating labor and material costs for process piping installations. Experience will show that accuracies of better than 10% are not unusual. (p. 243)



Charts to save calculation time

Design engineers will welcome this quick new nomographic way to estimate heat transfer coefficients for dense-phase fluidized beds. It's usable under a wide range of operating conditions. (p. 254)



The fine art of job switching

Are you underpaid, unhappy, mismanaged in your present job? Thinking about looking for a new one? If you are, here's some helpful advice and guidance from an engineer who's just made a switch. (p. 301)

CE is edited for the engineer concerned with chemical operations, whatever his function . . . administration, production and plant operations, design and construction, research and development, sales and purchasing More engineers subscribe to CE than to any other magazine in the field. Print order of this issue:

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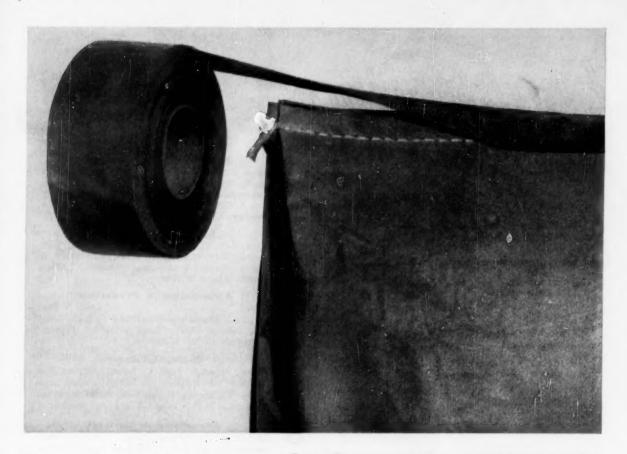
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Here's an economical, really <u>sift-proof</u> closure for your multiwall bags . . . BEMISTAPE plus T O S

Bemistape is the new, pressure-sticking tape developed and manufactured by Bemis especially for bag manufacturing and closing.

Its new and improved built-in adhesive sticks tightly and permanently and needs only momentary pressure. It does not deteriorate with age.

TOS? That means "Tape over sewing"...the tape applied over the sewn seam.

Put Bemistape and TOS together and you have your most economical, really sift-proof multiwall closure for both bottoms and tops.

Bemistape costs less than half as much as competitive pressure-sticking tapes for bag closing. And users report that it saves up to 25 percent as compared with creped tape and latex adhesive, by eliminating start-up and clean-up time and waste.

If you already have a machine for closing with tape, you're ready to use Bemistape . . . just a few quick

and simple adjustments are needed. That's all.

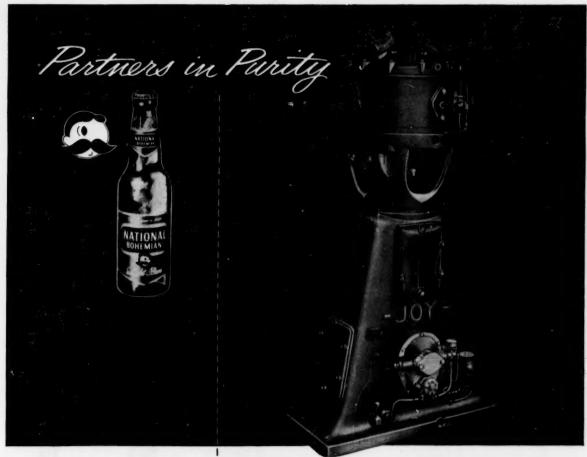
If you haven't a machine already, the new Bemistape Top Closing Machine will be the best paying investment you can make.

Or, if your volume is small, manual rollers do a fine job with Bemistape.

Get the complete, money-saving story about Bemistape and T O S from your Bemis Man.



Sales Offices in Principal Cities General Offices—408 Pine Street, St. Louis 2, Missouri



JOY OIL-FREE COMPRESSORS HELP GUARD QUALITY OF NATIONAL BOHEMIAN BEER

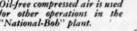


Oil-free compressed air is used

The National Brewing Company, Baltimore, Md., uses oil-free compressed air to regulate an important phase of their processing. Temperature control during pasteurizing is a critical point in the brewing of fine beer. Recording instruments control the steam inlet on preheat and precool tanks. The compressed air that operates these instruments must be free of oil and water or they plug up and record incorrectly.

National brewing hasn't had a bit of trouble with this operation since they installed their first Joy Oil-Free Compressor. These compressors use carbon piston rings that require no lubrication. No oil in the cylinder-no oil in the compressed air.

Is National Brewing happy? They placed a second Joy unit in operation a year later. Find out more about Joy oil-free compressors . . . write Joy Manufacturing Company, Oliver Building, Pittsburgh 22, Pa. In Canada: Joy Manufacturing Company, (Canada) Limited, Galt, Ontario.





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EQUIPMENT FOR INDUSTRIAL PLANTS ... FOR ALL INDUSTRY



NEED OIL-FREE AIR ... WRITE FOR FREE **BULLETIN 167-11**



INDUSTRIAL COMPRESSORS



CONVEYORS



ELECTRICAL CONNECTORS



FANS AND BLOWERS



Barber-Coloman



Bendix-Westinghouse Rotochamber



Conoflow



Fisher Governor



Foxboro Reversible Stabiflo



General Controls Hydramotor



Grinnell Air Motor, Spring Loaded



Grinnell Air Motor, Double-Acting

GRINNELL-SAUNDERS DIAPHRAGM VALVES

with famous name POWER OPERATORS



Grinnell Piston



Hammel-Dahl Close-Coupled



Hammel-Dahl Preloaded



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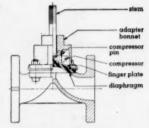
Taylor Motosteel

GRINNELL-SAUNDERS Diaphragm Valves are easily equipped for power operation — by combining any of numerous power operators, a sliding stem bonnet assembly, and a valve body. The sliding stem bonnet can be modified to accommodate any make of power operator, pneumatic or electric.

Grinnell-Saunders Diaphragm Valves are unsurpassed for handling materials as diversified as corrosive fluids, gases, beverages, foods . . . in lines where corrosion, abrasion, contamination, clogging, leakage and maintenance are costly factors.

The operating principal of the Grinnell-Saunders Diaphragm Valve is simple. The resilient, flexible diaphragm is lifted high when the compressor is raised and pressed tight against the body weir when the compressor is lowered.

Grinnell valves are available with body, lining, and diaphragm materials to meet different service conditions. For further information, write Grinnell Company, Inc., 291 West Exchange St., Providence, R. I. This sliding stem bonnet is specially designed for power operation. The power operator is attached to the adapter bonnet and to the threaded end of its free-sliding stem. Thus, the operating force is applied directly. The stem, in turn, is directly



connected to the compressor which opens and closes the valve when power is applied. This sliding stem bonnet is interchangeable with other bonnet designs.

GRINNELL WHENEVER PIPING IS INVOLVED



Grinnell Company, Inc., Providence, Rhode Island

Coast-to-Coast Network of Branch Warehouses and Distributors

pipe and tube fittings * welding fittings * engineered pipe hangers and supports * Thermolier unit heaters * valves

Grinnell-Saunders diaphragm valves * pipe * prefabricated piping * plumbing and heating specialties * water works supplies

industrial supplies * Grinnell automatic sprinkler fire protection systems * Amco air conditioning systems

Another new development using

B.F. Goodrich Chemical raw materials

they

KO'a

the drum—

but not

the coating!

Inland Steel Container Company, Chicago, Ill. offers drums and pails with this lining in a range of sizes from 1 to 65 gallons.

LOOK CLOSELY at this intentionally mangled steel drum. No cracks, flaking or peeling of the corrosion resistant coating—an organosol based on Geon polyvinyl resin.

Inland Steel Container Company offers this RDL-4 lining on drums and pails for handling highly corrosive liquids, bulk granulars and abrasive solids.

Linings made from Geon are remarkably resistant to abrasion, acids, alkalis and most chemicals. They are long-lasting, have excellent adhesion and high elasticity and are unaffected by temperature extremes or aging.

Geon-lined steel drums and pails

have already been proved successful as shipping containers for many materials. Some of these include: corrosive chemicals, aqueous non-solvent solutions, water emulsions, detergents, disinfectants, 50% lactic acid, phosphoric acid, slurries and abrasive materials like titanium sponge and slips for pottery.

You can put versatile Geon resins and compounds to work for you in many ways. For more details, write Dept. FH-6, B.F.Goodrich Chemical Company, 3135 Euclid Avenue, Cleveland 15, Ohio. Cable address: Goodchemco. In Canada: Kitchener, Ontario.



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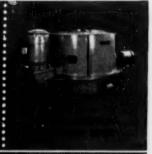
GEON polyvinyl materials - HYCAR American rubber and latex - GOOD-RITE chemicals and plasticizers - HARMON colors



START WITH THE MOST COMPLETE RANGE OF SOLIDS-LIQUIDS SEPARATING EQUIPMENT...











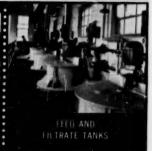




HAVE PILOT-SCALE TESTS MADE AT THE BIRD RESEARCH AND DEVELOPMENT CENTER . . .











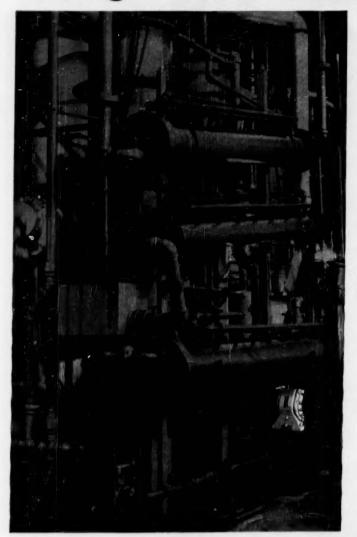




. AND END WITH THE MACHINE THAT'S RIGHT FOR YOU



varies gas feed to annealing furnace need





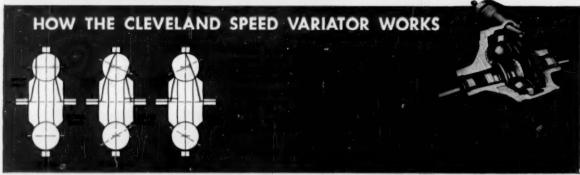
THIS gas blower is part of the monogas system that feeds an annealing furnace. Rate of gas output from the blower is precisely controlled by a Cleveland variable speed drive.

When the gas production rate must be decreased or increased to fit various annealing processes, it is easily regulated by a simple turn of the hand wheel on the drive. To maintain uniform supply of gas at all times, even if pump or compressor output varies, a simple adjustment on the Variator compensates and keeps the production rate steady.

This is one of hundreds of different applications of this unique Cleveland Speed Variator. Engineers and designers have put thousands of units into use on such diverse equipment as cigarette-making machines, textile machinery, metalworking machinery, pharmaceutical equipment, transfer tables, conveyors, testing equipment and experimental machines of many types.

Being infinitely variable, the Cleveland gives stepless speeds over a full 9:1 range—from 1/3 to 3 times input speed. Output speed on this particular application illustrated is adjusted by hand wheel, but could be regulated by either manual or automatic remote control. The Variator is available in 18 sizes, ranging from fractional to 16 hp at 1750 input rpm.

Write for Bulletin K-200 for detailed description with photographs, sectional drawings, rating tables and specifications.



THE CLEVELAND WORM AND GEAR COMPANY

Speed Variator Division, 3275 East 80th Street, Cleveland 4, Ohio

Sales Representatives in all major industrial markets . In Canada-Peacock Brothers Limited

Complete transfer oil heating systems in compact "packages"

WHITLOCK offers these standard "packages" including heating unit operating controls and expansion tank to heat chemically stable transfer oils. Since these oils are liquid over considerable temperature ranges, they are being used increasingly in chemical processing operations. The heating equipment, previously of special design, is now available as complete, standardized units to which only oil and electrical connections need be made to permit immediate operation.

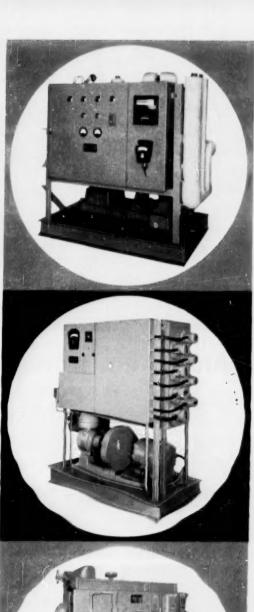
The combination of low liquid pressures and high liquid temperatures eliminates the need for the application of high pressure design techniques to many current processes. In more and more installations these new "packages" are effectively serving to reduce overall equipment costs and simplify process design. The units are available in Standard, or Group 1 Class D Explosion-proof Constructions. Temperature controls are carefully selected to maintain the oil supply temperature within $\pm 2^{\circ}$ F and the design precludes oil deterioration. Signal lights confirm satisfactory operation.

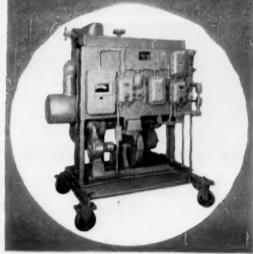
For additional information and prices write . . .

THE WHITLOCK MANUFACTURING COMPANY 94 South Street • West Hartford 10, Conn.

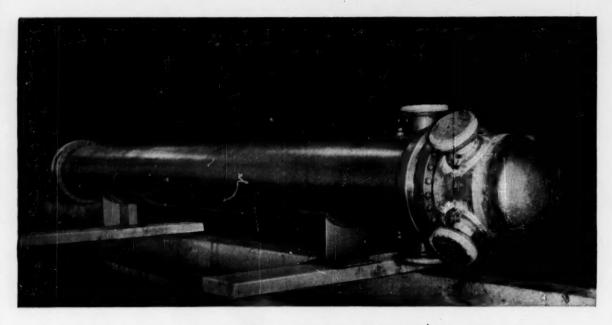
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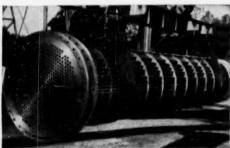
Designers and builders of bends, coils, condensers, coolers, heat exchangers, heaters, piping, pressure vessels, receivers, reboilers.



Aluminum translated by Downingtown... metallurgically speaking



Putting the finishing touch on another heat exchanger unit built by Downingtown.



We rolled type 329 stainless steel tubes into types 316 and 304 tube sheets in making this stainless steel replacement bundle.

The special problems of aluminum welding and fabrication are another metallurgical "language" that has been expertly mastered at Downingtown. In this fixed-tube sheet heat exchanger unit, aluminum heads, tubes and tube sheets have been combined with a carbon steel shell to meet specific service conditions.

When heat transfer specifications call for aluminum...or aluminum bronze, nickel, copper, stainless steel, or almost any clad or alloy...you'll find the metallurgical idiosyncrasies are well understood at Downingtown. Send for our informative booklet on heat exchanger design.

SPECIFICATIONS OF THE UNIT

Materials: Aluminum Tube Side and Carbon Steel Shell Tubes: 192 Alclad Tubes, ¾" O.D. x 16 ga. x 14'0" L

Shell Diameter: 18" Over-All Length: 16' 1"

Design Pressure: Shell Side, 100 psi—Tube Side, 200 psi
Test Pressure: Shell Side, 150 psi—Tube Side, 300 psi
Design Temperature: Shell Side, 250° F.—Tube Side, 350° F.
Code Stamped: Inspected by Purchaser and Hartford

Downingtown Iron Works, Inc.

140 Wallace Ave., Downingtown, Pennsylvania

division of PRESSED STEEL TANK COMPANY Milwaukee





Passes acid test -by more than 3 times

Unloading carloads of concentrated sulphuric acid proved a hose-killing job at this Gulf state fertilizer plant. Time after time, the acid charred the insides of a hose, making it brittle and easy to break. Even the best one could handle only 2,800 tons before it gave up the ghost.

Then the G.T.M.—Goodyear Technical Man-suggested HYSUNITE Hose. It's specially developed to carry highly oxidizing acids—even in high concentrations and at high temperatures hose could never

before handle. How did HYSUNITE do there? At last report, it had unloaded 9,900 tons. And it looks good for many more.

Here's one more proof, then, that hose problems just don't come too tough for the G.T.M. Put him to the acid tests — no matter what your hose need—by contacting your Goodyear Distributor—or writing:

Goodyear, Industrial Products Division, Akron 16, Ohio

HYSUNITE HOSE by

GOODFYEAR

THE GREATEST NAME IN RUBBES

Hysunite- F.M. The Goodyear Tire & Rubber Company, Akron, Ohio

It's smart to do business with your Goodyear Distributor. He can give you fast, dependable service on Hose, V-Belts, Flat Belts and many other industrial rubber and nonrubber supplies. Look for him in the Yellow Pages under "Rubber Goods" or "Rubber Products."

THE DIFFERENT AND IMPROVED WAY TO CONTROL PRESSURE, TEMPERATURE, RATE OF FLOW, LIQUID LEVEL . . .

OPW-JORDAN diaphragm motor valve

with the sliding gate and plate







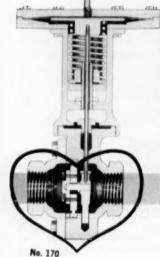
the heart of the OPW-JORDAN Valve

- . POSITIVE, DEAD END SHUT-OFF
- PRECISE, ACCURATE CONTROL
- WIDE RANGEABILITY
- SELF CONTAINED OR CONTROLLER OPERATED

Compact, sturdy, space-saving, the No. 170 offers the full advantage of accurate control and unusual sensitivity — straight through flow, with modulation thru the full valve opening — short stroke, fast reaction. Unique Sliding Gate and Plate design insures a positive leakproof shut-off and minimizes or climinates wire drawing.

Free Bulletin J-170 gives complete details, flow curve and capacity tables. Write today.



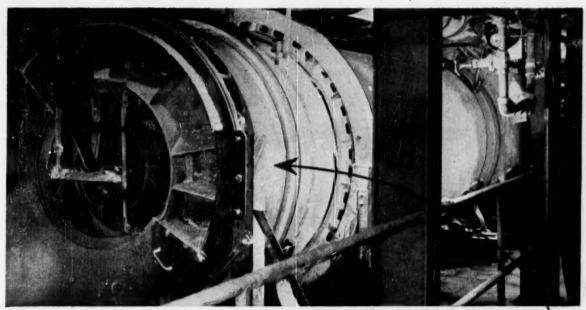


JORDAN CORPORATION

INDUSTRIAL SALES DIVISION OF OPW CORPORATION



6013 WIEHE ROAD CINCINNATI 13, OHIO ELMHURST 1-1352



BETTER BATH CRYSTALS and higher output were realized when Diamond Alkali Company installed this Link-Belt Roto-Louvre dryer at their Painesville (Ohio) plant. Uniform

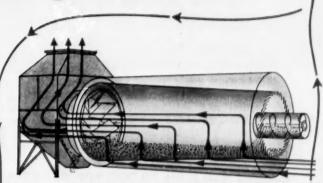
aeration and controlled, gradual drying strengthen crystal structure, resulting in more pleasing appearance. Gentle handling eliminated crystal degradation.

Repeat laboratory precision in full-scale production

with the LINK-BELT Roto-Louvre dryer

YES, it's easy to duplicate the quality of laboratory test samples on production runs using a Link-Belt Roto-Louvre dryer. Accurate "scale-up" is readily achieved because of Roto-Louvre's unique design and precisely controlled drying.

Compact and highly effective, this machine introduces dry, heated air through ever-changing channels, exposing the entire surface of every particle to uniform treatment. For facts, send for Book 2511. Or, if you prefer, send a sample of your material and we'll work out drying, cooling or roasting procedures you can duplicate in your own plant.



Common-sense design assures effective heat transfer

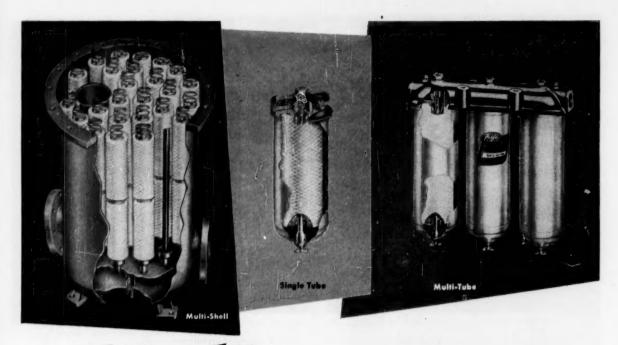
Roto-Louvre has largest volume of air penetrating thin bed of material near feed end, where greatest evaporation must take place. As material moves forward and bed becomes thicker, smaller air passages reduce volume of air passing through hed, preventing overheating. Precise control of input air temperature, exhaust and conditions of material travel assures maximum heat transfer per cubic foot of air.



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Fulflo Filters give you the right element and container FOR ALL TYPES OF INDUSTRIAL FLUIDS

Whatever liquid or gas . . . whatever flow rate, pressure, pH or viscosity . . . Fulflo Filters give you the right element and container to provide any desired degree of continuous micronic clarity.

Honeycomb Filter Tubes are made in a wide range of definite densities and a variety of natural and synthetic fibres — cotton, nylon, orlon, dacron, dynel, acetate or glass. Single-shell, multi-shell and multi-tube con-

tainers are available in iron and steel, steel, stainless steel, rubber-lined steel and nickelplated brass.

Fulflo Filters clarify all types of industrial fluids: liquid chemicals; petro-chemicals; pharmaceuticals; water; compressed air; CO₂ and other gases; liquid fuels; oils. Special models can be engineered for full-flow filtration up to 2000 gpm or pressures up to 5000 psi, at minimum pressure drop.





OIL FILTERS FOR BOTH SOLID AND SOLUBLE IMPURITIES

CFC Filters (including Honan-Crane models) provide selective filtration of virtually any oil under all operating conditions. Multi-Cartridge Filter (illustrated) gives you a choice of six types of interchangeable cartridges—inert media for suspended solids, or Cranite (fuller's earth) for removal of both solid and soluble impurities.

For technical data on nurro-fine filtration by natural and synthetic fibres, write for Bulletin AFD50-1B. Address Department CE.

Micro-Fine Filtration for Low Cost Clarity

COMMERCIAL FILTERS CORPORATION

MELROSE 76. MASSACHUSETTS

Plants in Melrose, Massachusetts and Lebanon, Indiana



FULFLO FILTERS WITH GENUINE HONEYCOMB FILTER TUBES FOR CONTROLLED MICRONIC CLARITY • CFC MULTI-CARTRIDGE OIL FILTERS
PURIVAC INSULATING OIL CONDITIONERS • DRI-PURE WATER-OIL SEPARATORS • PRE-COAT FILTERS • MAGNETIC SEPARATORS
AUTOMATIC TUBULAR CONVEYORS • COOLANT CLARIFIERS

CORROS/ES bandiod at LOWER FUMPING COSTS WHILFLEY

Pumping hot corrosive liquids and other hard-to-handle

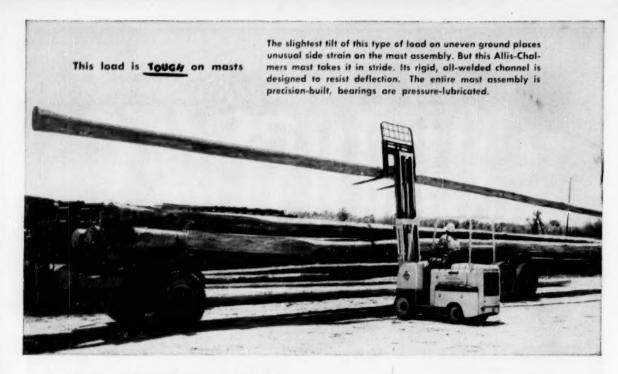


solutions is all in the day's work for Wilfley Acid Pumps. Actual production line records prove Wilfley creates substantial dollar savings in stepped-up, trouble-free performance and low cost operation.

Wilfley Acid Pumps are available with pumping parts of the machinable alloys as well as plastic to meet all requirements.

INDIVIDUAL ENGINEERING ON EVERY APPLICATION
Write, wire or phone for complete details.

"Companions in Economical Operation"
"Willey Acid Pumps



WIDE RANGE OF JOBS OFFER TOUGH TESTS FOR ALLIS-CHALMERS FORK TRUCK

Handles Everything from Pallet Loads to Piling for Freeport Sulphur Co.

Material for five Freeport Sulphur plants is stored at Harvey, La., and shipped out as needed by barge and LCT. An Allis-Chalmers 6,000-lb fork lift truck handles this material into and out of storage as well as on the dock.

The demand on this truck is constant and the types of loads almost limitless, yet every day it passes many severe tests of durability and versatility.

* * *

Write for free catalog on the complete Allis-Chalmers fork truck line or see your nearby dealer.

ALLIS-CHALMERS, MATERIAL HANDLING DEPT., BUDA DIVISION MILWAUKEE 1, WISCONSIN

ALLSS-CHALMERS



BH-5

This ramp is TOUGH on a clutch

Repeated trips up and down the ramp could wreck ordinary clutches. But the torque converter drive on this Allis-Chalmers fork truck eliminates clutch trouble, saves excessive engine wear and holds down fuel consumption.



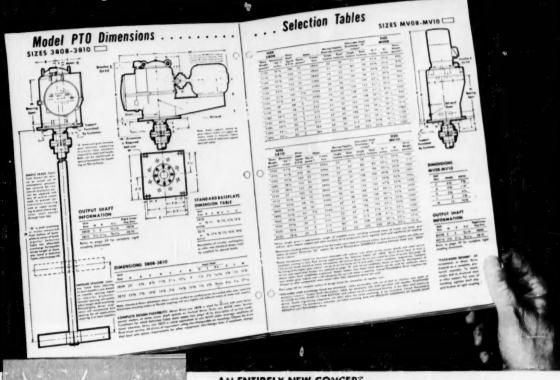
This job is Tough on nerves

Handling awkward loads in cramped quarters flanked by sheer drops calls for a skillful operator and a safe, responsive truck. Maneuvering an Allis-Chalmers is almost second nature to the operator right from the beginning. It starts, steers, shifts and drives like an automobile.



July 1957—CHEMICAL ENGINEERING

NOW - select your complete Fluid Mixer assembly from this catalog





FREE-This valuable catalog is yours upon request. When writing, use your business letterhead.

AN ENTIRELY NEW CONCEPT ...

Now for the first time—anywhere—Philadelphia Mixer presents easy-to-use, comprehensive mechanical design information permitting catalog selection of complete paddle and turbine type fluid mixers.

Choose the desired mixer drive type and size...correct lower shaft and impeller(s)...plus all other components including proper stuffing box or mechanical seal assemblies for pressure

You will know exactly how much space the mixer drive will occupy on top of your tank . . . how much head room is necessary for an installation . . . what tank opening must be provided for insertion of mixing impellers . . . what mixer supports must be furnished.

Determine the exact mixer assembly you need without unnecessary delay. No need to waste time and patience in lengthy consultation with outside sources.

REDUCE INSTALLATION COSTS . . .

Know early in your design project the required space for mixer installation and what room is available for other equipment. Avoid costly changes at a later date.

BE SURE OF CORRECT MIXER DESIGN . . .

Again, for the first time, you can select a complete mixer and be absolutely sure that it is a guaranteed sound, practical design which will assure optimum mixing performance.

philadelphia mixers PHILADELPHIA GEAR WORKS, INC.

ERIE AVE. & G STREET, PHILADELPHIA 34, PENNA. Offices In all Principal Cities

INDUSTRIAL GEARS & SPEED REDUCERS . LIMITORQUE

VALVE CONTROLS . FLUID MIXERS . FLEXIBLE COUPLINGS Virginia Gear & Machine Corp. . Lynchburg, Va.

Life on the Chemical Newsfront





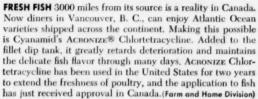
RICHER LATHERING OF LIQUID SOAPS in hard water is made possible by Cyanamid's Cyquest* 40 Sequestering Agent. By sequestering heavy metal ions Cyquest* 40 protects against the formation of undesirable insoluble soaps and insures sparkling clarity of soap formulations even after extended storage. Cyquest* 40 Sequestering Agent is a 40% solution of the tetrasodium salt of ethylene diamine tetra acetic acid, generally recognized as the sequestrant forming the most stable heavy metal ion complexes. (Industrial Chemicals Division, Dept. 8) *Trademork

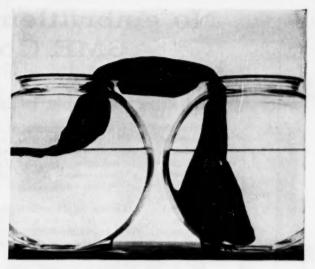
LASTING BEAUTY and liveliness that stays lively are qualities of rubber products made with Cyanamid's Unitane® Titanium Dioxide. Thorough purification and careful controls imposed in manufacture give Unitane Titanium Dioxide good whiteness, high brightening strength and excellent aging characteristics. White whites and bright pastels are assured by Unitane Pigments. (Pigments Division)



A NEW BIFUNCTIONAL ACRYLONITRILE DERIVATIVE, potentially low in cost, has been announced by Cyanamid. Now available in research quantities, β-sulfopropionitrile could be produced on a commercial scale at a price in the bulk chemical range. Melting at 243-244° C, soluble in water, hot methanol and glacial acetic acid, this interesting chemical combines the functionality of the nitrile group and the sulfonic group. If you are curious to find what you can do with it, send for data sheet and sample.







THIS "FISHBOWL TEST" graphically demonstrates the powerful wetting action of Decenesol.® Wetting Agents. The tank on the left contains plain water, and the tank on the right contains water with 0.025% Decenesol. Wetting Agent. Plain water hardly wets the fabric, which continues to float, while the treated water wets rapidly, causing the fabric to sink quickly. The rapid wetting action of Decenesol. Wetting Agents, which are stable through a wide pH range, aids greatly in such textile treating operations as desizing, bleaching, dyeing and finishing. They do not affect the appearance or feel of the treated fabrics.

(Organic Chemicals Division)



TWO NEW IMPACT-RESISTANT COATING RESINS for metal finishes have been introduced to the paint industry. Cvzac* 1006 and 1007 Resins provide an unusual combination of properties in enamels for metal: maximum hardness with much greater impact and chemical resistance than conventional finishes. Among ex-

pected major uses are finishes for metal toys, appliances, automobiles and metal cabinets and furniture. Other properties imparted by these resins are flexibility, high gloss and gloss retention, unusually good enamel stability and better adhesion.

*Trademark (Plastics and Resins Division)

CYANAMID

AMERICAN CYANAMID COMPANY

Helping America Make Better Use of Its Resources



For further information on these and other chemicals, call, write or wire American Cyanamid Company.

No embrittlement! Lowest cost! ASME Code approved!

In the subzero operating range . . . Specify Alcoa Aluminum equipment and piping

The flow chart details a tonnage oxygen plant now in actual operation where process temperatures average below minus 300° F. Notice that virtually all of the equipment and process piping are ALCOA® Aluminum. There's a good reason: aluminum is the lowest cost metal able to perform satisfactorily at low temperatures.

At subzero temperatures, ASME code approved aluminum alloys suitable for welded construction display improved yield and tensile strengths with no reduction in ductility or resistance to shock loading (see graphs). There is no embrittlement!

And in these operating temperature ranges, aluminum offers other valuable benefits . . . light weight

... excellent resistance to corrosion ... great strength in alloys . . . high thermal conductivity . . . non-magnetic, nonsparking characteristics . . . nontoxicity . . . and excellent reflectivity. It is highly workable and lends itself readily to a variety of welding or brazing techniques for easy fabrication.

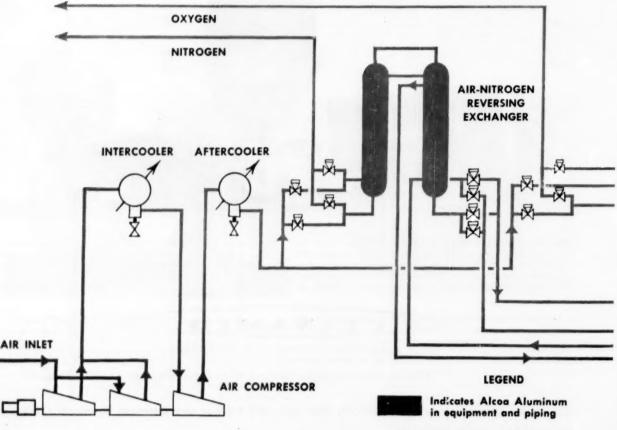
When you are looking for a low cost answer to the many problems of satisfactory equipment and piping performance in low temperature operations, it will pay you to specify Alcoa Aluminum. ALCOA engineers have worked with aluminum in the process industries for over 30 years. Use their accumulated knowledge to help you find satisfactory answers to your process equipment problems. Consult the nearby ALCOA sales office listed in the Yellow Pages of your telephone directory... or outline your equipment requirements in a letter to ALUMINUM COMPANY OF AMERICA, 903-G Alcoa Building, Pittsburgh 19, Pa.

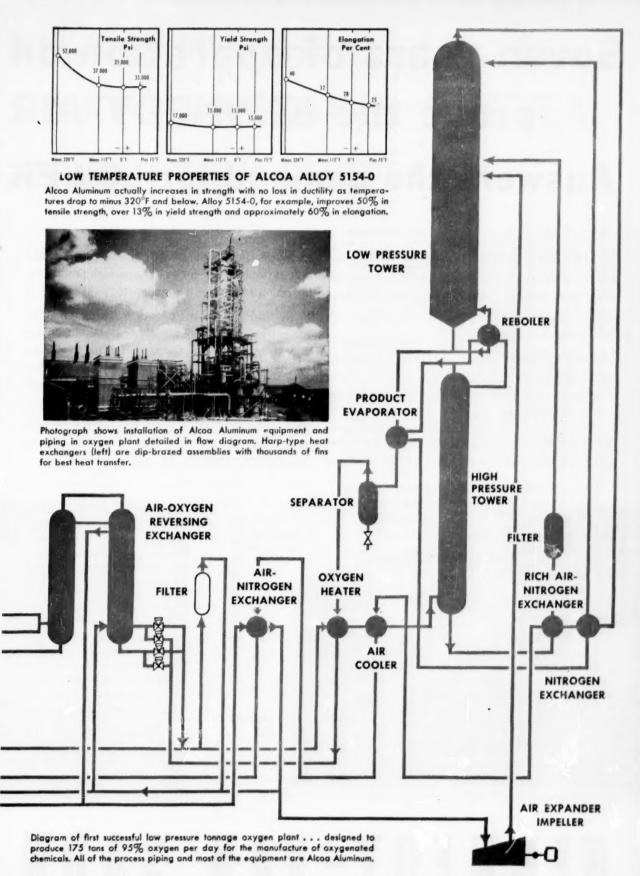






THIS FREE BOOK is filled with detailed data on the behavior of aluminum in the process industries . . . the result of more than 30 years of Alcoa engineering experience with aluminum in a variety of applications in nearly every temperature range. Use it as your guide to trouble-free, corrosion-free process equipment and piping. Write today for Process Industries Applications of Alcoa Aluminum.





Seven years of operation on prove the KENNEDY AIR Answers the demand for LOWER

Over the past seven years three of the most prominent producers of fertilizer from Florida Phosphate Rock have installed Kennedy Air Swept Grinding Systems for reduction of pebble, concentrate and combinations of both.

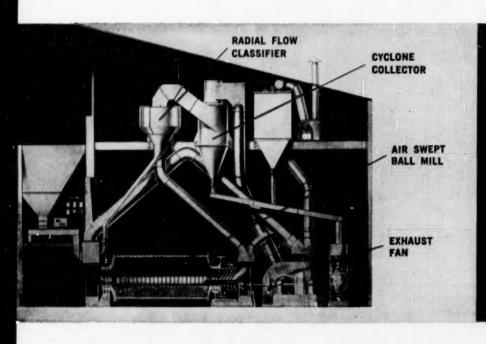
THEIR EXPERIENCE HAS PROVEN THAT THE SAVINGS IN MAINTENANCE AND POWER ALONE AMORTIZE CAPITAL INVESTMENT WITHIN A FEW YEARS!

The reduction of grinding costs is vital to the Phosphate industry and, in the grinding of more abrasive

materials, the ball mill has long been accepted as the only type pulverizer for continuous high production operation and lowest maintenance.

With steadily rising costs for operating and maintenance personnel as well as higher cost building space and structural work, the need for more efficient machinery becomes a "must." Decreased grinding costs mean an improved competitive position and larger profits.

THE KENNEDY AIR SWEPT BALL MILL GRIND-ING SYSTEM IS THE ULTIMATE IN HIGH PRODUCTION AND LOW COST OPERATION.



THE KENNEDY AIR SWEPT BALL MILL, ENGINEERED FOR THE PHOSPHATE INDUSTRY.

Kennedy Radial Flow Classifier is adjustable while system is in operation . . . wide range of product sizes . . . high degree of accuracy. No internal moving parts . . . all points of high velocity protected by wear-resistant materials.

Send for full details on this equipment.

KENNEDY-VAN SAUN

Florida Phosphates SWEPT GRINDING SYSTEM PRODUCTION COSTS!

OUTSTANDING FEATURES

Lower Maintenance

Tramp iron, manganese, and other foreign material cannot damage system. No magnetic separation required.

Continuity of Operation

Grinding balls added while mill is in operation, maintaining constant level of grinding media. Production and fineness remain constant, month after month. No periodic shut-down for lubrication or replacement of wearing parts. Years of operation assured before parts (other than grinding balls) require replacement.

Minimum Power

Lower Operating Costs

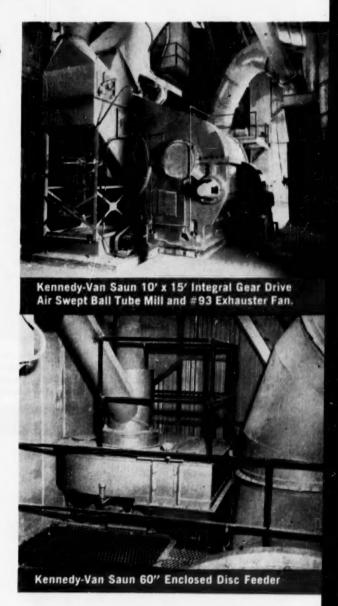
Dependability of equipment and reliable automatic feed control assure high production with minimum operating personnel.

Higher Production

Single grinding unit capacities to 75 tons per hour, requiring less floor space and structural work per ton of production.

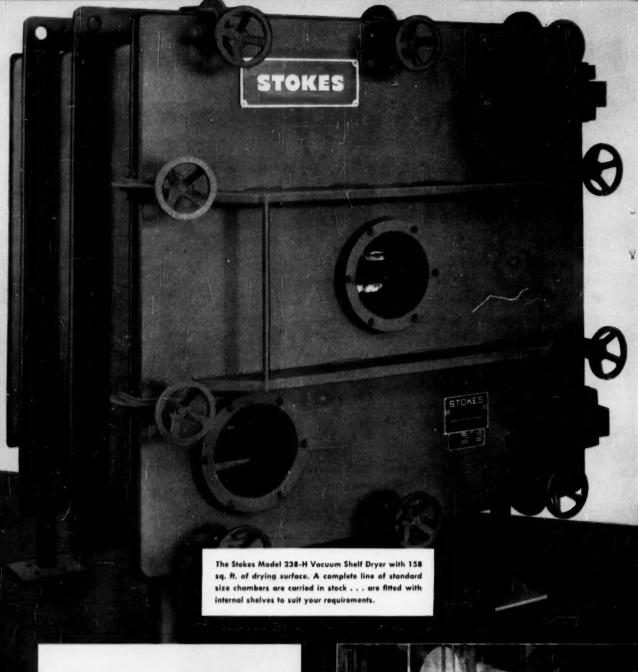
Flexibility of Design

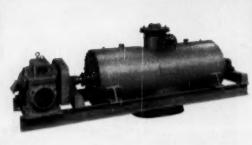
Kennedy-Van Saun Air Swept Ball Mill Grinding Systems available in a wide range of capacities to meet your requirements.



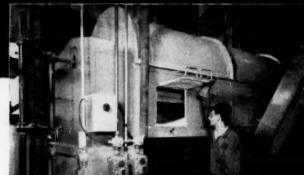
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TWO PARK AVENUE, NEW YORK 16, N.Y. . FACTORY, DANVILLE, PA.





Relary vacuum dryers are used for fast, thorough, uniform and economical drying of large batches with minimum labor. Heat is provided through the horizontal jacketed shell, and agitation through a center shaft. Solvent recovery can be had through condensation of the vapor. Broad range of sizes.



Drum dryers and flakers are used for continuous processing, at high rates, or materials that are not adversely affected by atmosphere. Material dries or solidifies on the heated or cooled surface of a revolving drum and is removed by a doctor blade. Wide selection of single and double drum models.

OTHER STOKES EQUIPMENT FOR CHEMICAL PROCESSING

New Stokes Vacuum Shelf Dryers can improve your products—

where development or production involves drying heat-sensitive, air-sensitive, or pyrophoric materials... or materials that require drying without agitation

Vacuum shelf drying offers many outstanding advantages where these product characteristics create problems in process or quality control. Heat-sensitive materials can be safely dried at low temperatures under vacuum, since the environmental pressure is reduced below the vapor-pressure of the contained water or solvents. Oxidation or contamination by air, and solvent explosion hazards are eliminated. Recovery of expensive solvents can be virtually complete.

The vacuum shelf drying technique eliminates agitation and mechanical friction from processes involving materials which must remain dormant during the drying period. It also provides a safe environment for drying pyrophoric materials such as zirconium and titanium.

Arranged for heating by hot water, steam or special heat transfer fluids, the new Stokes shelf-dryer design carries ASME Code Certification on all pressure parts as a standard feature. Fabrication is from ASME Code-inspected materials by Code-certified welders, with inspection according to ASME Code procedures.

In another major design improvement, all manifold connections are outside the chambers, avoiding all risks of leaks and product contamination within the chambers. Initial costs of shelf-drying systems are low . . . an important factor where quantity requirements are relatively small.

The Stokes 238 line of vacuum shelf dryers are part of a broad line of equipment for the chemical and processing industries. Stokes maintains a complete applications and process development laboratory for analysis of the requirements of your products. Write to Stokes or contact your nearest Stokes office.



Vacuum freeze dryers preserve potency and volatile constituents in many materials by converting them to a dehydrated form that maintains cell structure. Materials possess remarkable solubility and rapid reconstitution to original form. Sizes for laboratory, pilot plant and production.

Vacuum Processing Division
F. J. STOKES CORPORATION
5500 Tabor Road, Philadelphia 20, Pa.



OPTIMIZING CONTROL discussed by Manny Otis

Industrial process control today generally consists of a series of unrelated minor control loops. Each loop measures but one variable at a particular time and controls excursions of this variable within predetermined limits from a set-point selected by an operator.

Trends within individual control loops are not obvious—that is to say similarities and dissimilarities in plant operating conditions are ill-defined—and the operator is unable to anticipate with sufficient rapidity interrelationships in such trends. This essentially precludes use of available data to the fullest advantage. Furthermore, it is easy to demonstrate that the limits within which a process variable can be held automatically are several orders of magnitude smaller than can be attained by a human operator in establishing the set-point for such limits. Hence, in making his decisions, the operator is at a marked disadvantage.

All of this leads us to the generalization that processes are controlled, but that the control function is not optimized. And as a rather natural extension of this generalization, if optimum control is incorporated into a process, the efficiency of the process can be expected to increase.

The first step toward this desirable objective has already taken shape with the development of electronic data logging systems. Many such systems are now available to industry. The unavoidable time lag between recording, correlation, and evaluation in such systems is so great, however, that the effectiveness of solutions provided for process control decisions is essentially nil. Hence, the data serve primarily to provide an insight into process dynamics.

In optimizing the continuous process, different variables must not only be sensed but correlated in real time in order to yield control decisions before plant operating conditions have changed appreciably. To achieve this, remedial control decisions must be initiated before the predetermined control-limits have been reached.

Progress in the theory of nonlinear adaptive control is providing the mathematical background necessary to define the necessary correlation procedures; digital computer techniques will play a decisive role in implementing the theory. Closing the loop in a continuous process, therefore, places tremendous demands upon the system's designer. A control system that is to replace a human being must be able to do so continuously and infallibly. Demands for ever greater reliability (one error in several hundreds of millions of decisions) and longer life are achieved with the use of solid state components. And since environmental conditions in industrial processes rarely are controlled as equably as in an office or a scientific computation center, circuit design and packaging requirements must be adapted to the widest range of operating climate.



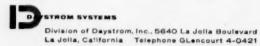
Emmanuel J. Otis, systems design engineer discusses control optimization

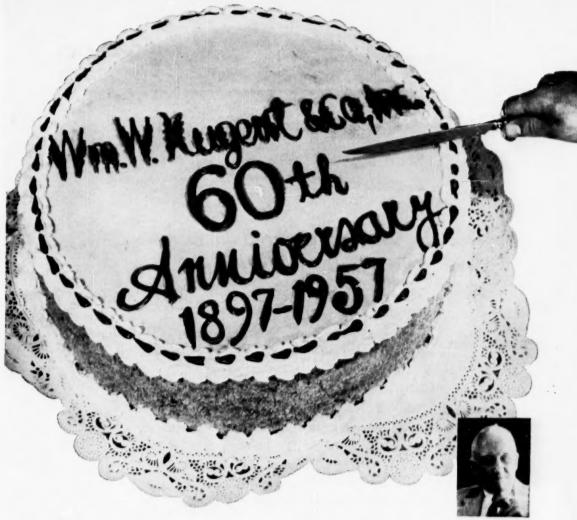
The proper selection and integration of the necessary units required to "marry" the control computer to the process are dependent upon the desired speed and accuracy of the overall system. Hence, specific process requirements must govern the design of the control system in order to achieve the optimum use of equipment. These process characteristics must define speed, degree of accuracy, memory capacity, and flexibility—prime factors that determine the size and complexity, and therefore the price and economic justification for, such control equipment.

In closing the loop, digital computers and attendant devices will optimize industrial process control systems by providing minor control loop set-points. Eventually, minor control loops will be replaced altogether. At that time, control decisions will be made and operating instructions provided by the control equipment to devices that will govern the functioning of process variables.

The day of totally optimized control is not far off!

By applying the latest proven techniques, our well-qualified staff at Daystrom Systems is prepared to take single responsibility of assembling and installing a system to meet your needs. We are currently compiling a file of new applications and papers on various parts of systems, both industrial and military. If you are interested in receiving the file and periodic additions, please write us.





Before we cut the cake...

Wm. W. Nugent & Co., Inc., on the occasion of its sixtieth anniversary, wishes to express its sincere appreciation for the confidence and loyalty toward Nugent products, demonstrated by an ever increasing acceptance throughout industry.

For three generations, Nugent products have embodied only highest quality design, materials and workmanship. The future shall find no compromise with that policy.



Wm. W. Nugent & Co., Inc. 3458 Cleveland Street

OIL FILTERS, OILING AND FILTER-ING SYSTEMS, TELESCOPIC OILERS, OILING DEVICES, SIGHT FEED VALVES, FLOW INDICATORS Representatives in Boston • Cincinnati • Detroit • Houston • Los Angeles • Minneapolis • New Orleans • New York • Philadelphia • Portland, Oregon • San Francisco • Seattle • St. Louis • Tulsa • Representatives in Canada: Montreal • Toronto • Vancouver





CORLISS D. NUGENT



VM. WARREN NUGENT

a series about

PROCTOR SERVICES

for your new products



Mr. Albert G. Blank Sales Manager Process Industries Sales

No. 5: your needs and Proctor's sales service

Satisfaction of your needs is the ultimate aim of Proctor's sales service.

In the preliminary aspects of a drying problem your basic requirements have been reviewed and are incorporated into the preparation of a proposal for your consideration. It is important that there be a check point in the development of a proposal so that a mutual interpretation of the needs and the satisfaction of these needs by equipment recommended can be determined.

In this phase of progress of the job, Proctor's sales service affords the means of analyzing the accumulated data on the job.

Through a mutual review of the whole problem, it is finalized in all respects and it is then ready for the action of purchase of equipment.

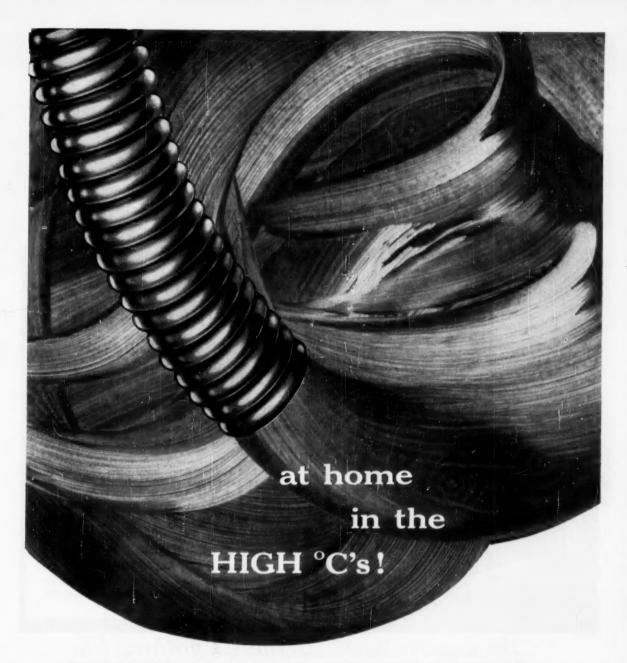
In this manner nothing is left to chance; the job has been thoroughly explored and you can purchase with confidence.

Proctor guarantees satisfaction for your profit and we'd like to show you what Proctor's sales service means to you the next time you plan a dryer installation.



PROCTOR & SCHWARTZ, INC.

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PUT ATLANTIC FLEXIBLE STAINLESS STEEL HOSE TO WORK in any inferno of high temperature and high pressure corrosive gases and liquids. It Stands Up!... Every inch... JOB TESTED & CERTIFIED... for unequalled leakproof qualities, durability, strength and lightness. Use it to control movement and vibration... correct misalignments... to compensate for expansion and contraction... in process lines... for loading and unloading.

Available in sizes ½"-4" I.D. inclusive with appropriate fittings. Produced in various alloys of stainless steel —— in monel, bronze, and carbon steel. Write for Bulletin 21-A. See our Catalog in Sweet's File for Product Designers.

ATLANTIC METAL HOSE CO., INC.



329 Dyckman Street, New York 34, N.Y.

the big league ball player
has his equipment
custom-made because he
gets something EXTRA





the profit-wise producer BUYS TRAYLOR KILNS because they provide something EXTRA, too

Leading producers have long been buying Traylor-made Kilns for thermo-processing. They like the extra production efficiency that comes with a Kiln Traylor-made to their individual requirements.

Traylor Rotary Kilns have been built up to 12' in diameter and 450' in length. Bulletin No. 115 fully describes the many Traylor features that will put extra profits in thermoprocessing for you, too! Write for your copy, today.

TRAYLOR ENGINEERING & MFG. CO. 1900 MILL ST., ALLENTOWN, PA.

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the experts agree . . . there's nothing like

TRAYLOR-MADE

equipment for peak performance









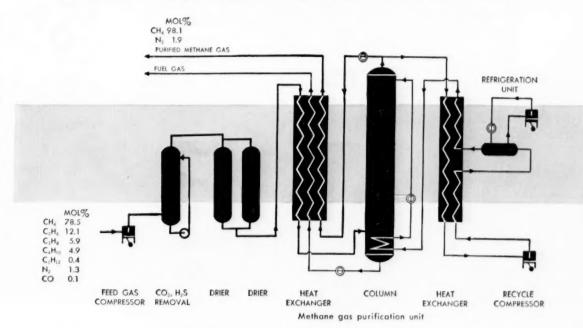




34

practical approach to

METHANE PURIFICATION



In the production of chlorinated methane compounds and other chemicals based upon methane, the methane processed must be of ultra high purity. Air Products low-temperature processing plants—accepted as the most economical and practical approach—produce methane containing less than 100 p.p.m. of other hydrocarbons.

Air Products methane purification plants feature many cost-saving and special processing advantages:

- · extremely high-purity methane, bone-dry and CO2-free.
- · valuable by-products—LPG, other heavy hydrocarbons, nitrogen.
- · automatic control-requiring a minimum of labor.
- · low power consumption.
- · factory-assembled plants—assuring minimum installation expense.

Many chemical plants are already using Air Products low-temperature equipment. In addition to the production of ultra high-purity methane, Air Products units are being used for the production of oxygen, nitrogen, argon and hydrogen . . . as well as the processing of natural gas, carbon monoxide, deuterium, fluorine and helium.

Here at Air Products, we design, manufacture, erect and operate . . . package, tonnage and custom-built industrial gas separation, lique-faction and purification systems. No matter what your requirements, Air Products will find a way for you to acquire or lease low-temperature equipment on mutually convenient and beneficial terms. Your inquiry is invited. Air Products, Incorporated, P. O. Box 538, Allentown, Pa.

Air Products



PYROCERAM is an entirely new basic material made from glass. We think it is the most important technological break-through ever made in glass research.

Actually, PYROCERAM is not just one material, but a whole new class of materials that can be mass-produced in any shape glass can be. We've already experimentally melted over 400 different kinds with widely varying properties. And we'll continue to make many more as our development work progresses.

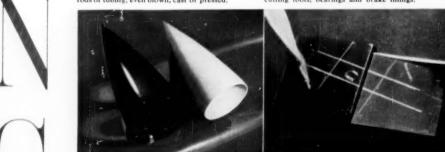
Uses? One we're actively investigating right now is Pyroceram for the conical noses of guided missiles—called radomes. We've developed a Pyroceram that will stand up in flight at the unbelievable speeds missiles will soon be traveling. Future uses for Pyroceram are limited only by the ingenuity of American industry.

Pyroceram starts out as a glass. But it isn't really a glass at all when we get through heat-treating it by a special technique we've developed. Because of a unique

The sky's not the limit! Heat-treating changes this Pyroceram from a glass into a new basic material of unlimited usefulness (below, nose of a guided missile). Pyroceram can be mass-produced to close tolerances. It can be drawn into sheets, rods or tubing; even blown, cast or pressed.

Harder than steel. Tests show some kinds of Pyroceram are 27 times more resistant to sandblasting than glass, and are harder than hardened steel (below, Pyroceram scratches steel and brass). This hardeness suggests such uses as special cutting tools, bearings and brake linings.

Still rigid at 2,200° F. This Pyroceram isn't deformed by heat that warps steel and melts copper. And we can tailor the coefficient of expansion of this material . . . make kinds that expand, shrink or remain the same size when heated. Indicated uses: cooking bans to blades for turbine engines.



J...can do almost anything



combination of ingredients in the original glass formula, heat changes the actual molecular structure of the glass. It becomes Pyroceram - a material extremely hard, lightweight and non-porous.

Pyroceram can be made white and in color. We've even made some kinds that are transparent. Some have superb chemical and electrical properties; some kinds are stronger than bronze; some aren't deformed by temperatures that warp stainless steel.

> Stands up to corrosive chemicals. Here's a Pyroceram that's unharmed by an acid solution that severely attacks steel, aluminum, copper and magnesium Pyroceram also has great alkali resistance And it combines chemical resistance with remarkable strength and heat resistance.

are looking into dozens of possible uses for Pyroceram. And we have just dedicated the new Eugene C. Sullivan Research Laboratories, which will enable us to broaden all our activities in Pyroceram research and glass research in general. For the latest information on Pyroceram and our thousands of other glass products, write Director of Sales, Corning Glass Works, 7 Houghton Park, Corning, New York.

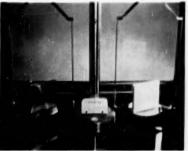
Right now at Corning our scientists and engineers

As lightweight as aluminum ... which means that Pyroceram may some day be used as the "skin" of supersonic aircraft and other air-borne parts. Pyroceram is also a beautiful material-smooth as glass, easy to keep clean. It should be ideal for

Stronger than bronze. Some kinds of Pyroceram have greater tensile strength than cast iron, brass and bronze...keep this strength under the intense heat of two acetylene torches. This makes it a good bet to see service as pipe for processing equip-ment, high-temperature heat exchangers







CORNING GLASS

CORNING. NEW YORK



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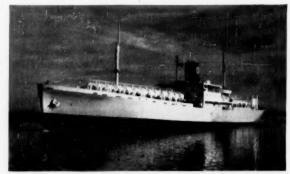
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BETHLEHEM AT BEAUMONT

The Nation's Leading Builder and Converter of Waterborne L.P. Gas and Ammonia Vessels



S.S. Natalie Warren, converted to L.P. Gas Carrier. Water capacity 38,000 barrels.



S.S. Ultragaz, converted to L.P. Gas Carrier. Water capacity 17,100 barrels.



Ammonia Mariner, seagoing Anhydrous Ammonia Barge. Water capacity 721,270 gallons.



Esso Viru, oceangoing L.P. Gas Barge. Water capacity 220,000 gallons.



Panama City, rivergoing L.P. Gas Barge. Water capacity 393,000 gallons.



Port Everglades, oceangoing L.P. Gas Barge. Water capacity 550,000 gallons.

These craft are indicative of Bethlehem's activities in the construction and conversion of specialized vessels for the economical and dependable waterborne transportation of L.P. Gas and Anhydrous Ammonia. If you have a problem involving the shipment of these or other petro-chemical products, we may be able to help you. Your inquiries will receive prompt attention.

NAVAL ARCHITECTS MARINE and NUCLEAR ENGINEERS

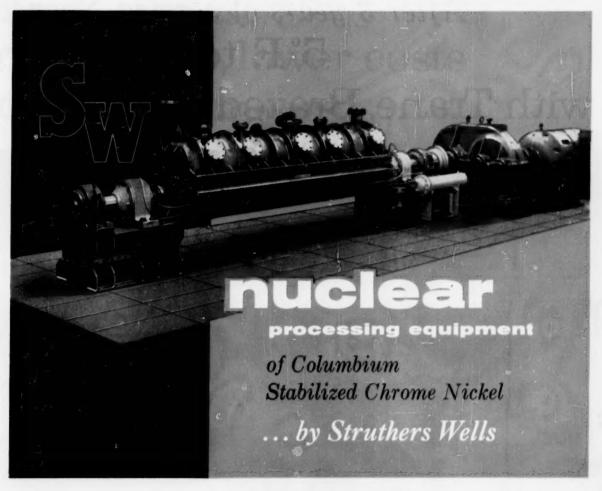
Unusual opportunities in many engineering categories are now available. Here's a once-in-a-lifetime chance to join the world's foremost shipbuilding organization. Address Dept. 272.

BETHLEHEM STEEL Shipbuilding Division

GENERAL OFFICES: 25 BROADWAY, NEW YORK 4, N.Y.

On the Pacific Coast shipbuilding and ship repairing are performed by the Shipbuilding Division of Bethlehem Pacific Coast Steel Corporation





EXPERIENCED,
EQUIPPED AND MANNED,
FOR THE DESIGN,
FABRICATION AND WELDING
OF SPECIAL NON-FERROUS ALLOYS

STRUTHERS WELLS PRODUCTS

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Crystalizers . . . Direct fired Heaters . . . Evaporators . . , Heat Exchangers . . , Mixing and Blending Units . . . Quick Opening Doors . . . Special Carbon and Allay Processing Vessels . . Synthesis Converters

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MACHINERY DIVISION

MACHINERY for Sheet and Structural Metal Forning . . . Tangent Benders . . . Folding Machines . . Raller Table and Tumble Die Bending Machines . . Press Brakes . . Punting and Notching Machines . . Forming Dies

A recent example of Struthers Wells ability to design, fabricate and weld, using the special non-ferrous alloys, is this intricate machine for the processing of nuclear materials. This equipment was fabricated from Columbium stabilized Chrome Nickel to provide an ultimate of strength and corrosion resistance at extremely high temperatures. It features oil-cooled shaft bearings and agitators driven by 150 hp variable speed motors. The vessel trough was fabricated from one-inch thick plate with a heavy flange around the top.

This is typical of the special equipment designed, welded and fabricated by the experienced personnel of Struthers Wells Corporation, whose complete facilities include unusually adequate equipment for stress relieving, annealing and quenching.

STRUTHERS WELLS Corporation

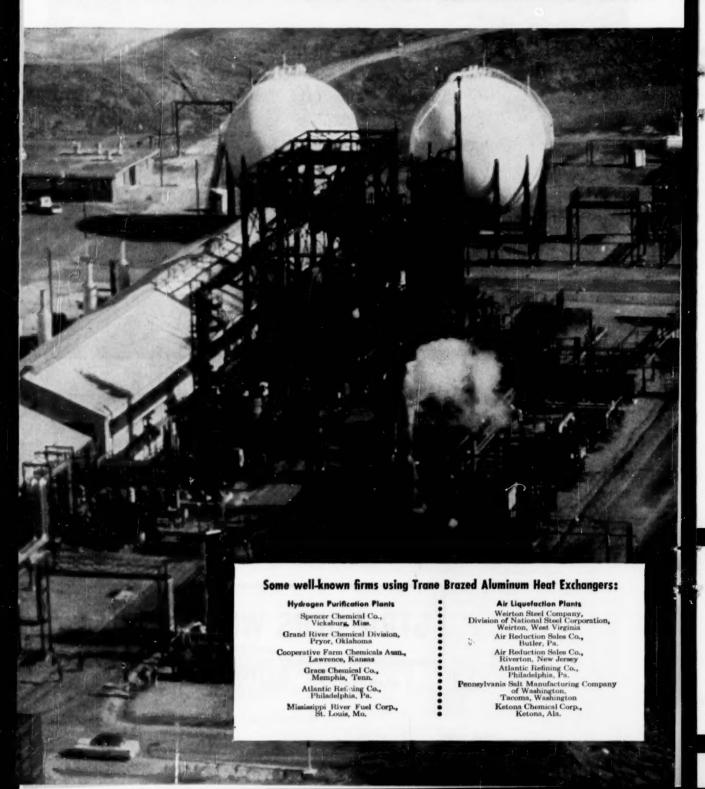
WARREN, PA.



Plants at Warren and Titusville, Pa.

Representatives in Principal Cities

After 3 years of service, Spencer 5°F. temperature with Trane Brazed Aluminum



Chemical reports... approaches, lower costs Heat Exchangers!

Trane equipment operates at -300° F. in first ammonia plant using Texaco-HRI methane process

Spencer Chemical's Vicksburg, Mississippi plant is one of the country's most modern and efficient producers of anhydrous ammonia from air, natural gas and water. A more economical production of ammonia and related chemicals has been achieved by the use of the Texaco-HRI methane process—and helped by the efficiency of Trane heat transfer equipment.

When this plant was designed, the engineers turned to TRANE for Brazed Aluminum Heat Exchangers for use in the nitrogen wash scrubbing system illustrated below. Here the synthesis of gas undergoes final stages of purification at temperatures below -300°F.

After three years of operation, Spencer reports that the performance characteristics of the Trane Brazed Aluminum surface make it possible to maintain a temperature approach in the range of 5°F. at the cold end—thus reducing power costs for refrigeration. The Trane Brazed

Aluminum Exchangers save space and construction costs, too. Conventional exchangers would have required approximately *twice* as large a cold box as that shown below.

Many of today's most modern low temperature gas separation plants rely on efficient Trane Brazed Aluminum Heat Exchangers for cutting costs, maintaining highest production standards. If you have a heat transfer problem involving low temperatures, multi-stream operation or close approaches, turn to Trane! Thirty years of varied heat transfer experience is at your service. Ask your Trane Sales Office for information, or write Trane, La Crosse, Wisconsin.

For any air condition, turn to

TRANE

MANUFACTURING ENGINEERS OF AIR CONDITIONING, HEATING, VENTILATING AND HEAT TRANSFER EQUIPMENT

Spencer Chemical Company's Vicksburg, Mississippi ammonia plant is currently producing about 200 tons of anhydrous ammonia per day, using two sets of Trane Brazed Aluminum Heat Exchangers in the process. Operating temperatures are as low as -300°F, with a temperature approach in the range of 5°F, at the cold end. The ammonia produced has a purity of 99.99 percent.

Nitrogen wash cold box was designed and built by Foster-Wheeler Corporation. The hydrogen-nitrogen stream leaving the nitrogen scrubbing system contains less than 10 parts per million of carbon monoxide and traces of carbon dioxide are completely eliminated. Cold box is approximately half the size that would have been required with conventional heat exchangers.



TRANE Braxed Aluminum Exchangers, either individual cores or multicore assemblies, as shown (right), can be headered for multi-stream operation combining as many as four different heat exchangers in one unit. Inherent properties of aluminum and unique design make these exchangers ideal for low temperature applications used in gas separation plants.



Report No. 2 of a series

I used to be all wet until I found



Kathabar[®] systems eliminate

wet floors, walls, equipment, and products!



Think what it would mean to you if you could eliminate condensation and its corrosion problems from plant processing and storage areas, and keep work spaces dry even when they're hosed down regularly for sanitation.

Maintenance savings alone would improve your profit picture for the year. Increased life of your structures and equipment would pay long-term dividends. Storage losses from condensation would be a thing of the past.

Such profits are immediately available to you in a Kathabar-engineered air conditioning system.

let's look at cases

This sampling of Kathabar installations will show you how effective and versatile a Kathabar system can be.

waterworks case

Pipe galleries in a huge waterworks are completely surrounded by water as cold as 40 F. A Kathabar system maintains the air at below the water dew point, year-round, and eliminates condensation. This system paid for itself in less than three years.

brewery case

In the new cellars of a large midwestern brewery, a Kathabar system is earn-

ing profits by elimating condensation. Washdowns are less frequent; dry cellars curb bacterial growth. As a bonus benefit, the Kathabar system kills 97% of all airborne micro-organisms. The brewmaster's temperature curve is followed precisely.

candy case

A candy manufacturer was plagued by condensation on the cooling slabs in his enrobing room. The moisture made his conveyor belt expand and jam. Chocolate and starch dust gummed up the belt and stopped production. A Kathabar system not only eliminated these problems, but increased production by 25%.

marine case

Kathabar systems in cargo ships and tankers provide anti-corrosion control, protection against cargo contamination, and ready gas freeing of all tanks. Kathabar systems quickly amortize themselves in maintenance savings, longer bulk-head life, better cargo protection, and faster turn-around.

other cases

Consulting engineers combine radiant panel cooling with Kathabar systems to dehumidify fresh air makeup. Colder water can be used in the panels, increasing efficiency without the danger of condensation.

Unitized Kathabar systems, using only electric power, dehumidify government storage caves. Completely portable, they are readily spotted to keep the dampest areas bone dry. Individual units avoid the fire hazard of a central system.

who uses Kathabar systems

Kathabar systems make profits out of air for these industries:

Atomic Energy Machining Breweries Matches Cake Mix Marine Candy Meat Cellophane Offices Cellulose Ordnance Cereals Paper Chemicals Pharmaceuticals Coffee Plastics Comfort Printing Compressors Rockets Cookies Rubber Electronics Shellac Explosives Sugar Film Sanitaryware **Foundries** Testing Textiles Gelatin Glass Transformers Glue **Transistors** Vacuum Tubes Gum Varnish Hospitals Hotels Waterworks Lacquer Wire Yeast Lenses

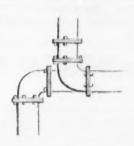
how they use Kathabar systems

Many of these industries use Kathabar systems for eliminating condensation. Others use them to (1) obtain continuous air at sub-freezing dry bulb and dew points; (2) maintain spaces below 80 F and 55% RH; (3) deliver sterile air at specified dry bulb and dew point; and (4) improve drying processes.

send description of your problem Air Conditioning and Drying Division SURFACE COMBUSTION CORPORATION

2380 Dorr Street Toledo 1, Ohio







Kathabar systems by



NEW 600# STEEL

NEW

TYPE 5500 — 600# GLOBE INTEGRAL HARD-FACED SEATS "500 Brinell"

Stainless Steel Discs.



Especially suitable for high pressure steam and temperature services in power plants. Sizes: $\frac{1}{4}$ " thru 2". Standard Materials: Forged carbon steel A.S.T.M. A-105 Gr. II. Alternate Body and Bennet Materials: $\frac{1}{4}$ % Chrome, $\frac{1}{4}$ % Moly Steel, A.S.T.M. A-182 Gr. F-11. Connections: Screwed and Socket Weld Ends. For all pressures up to 600 psi at 910°F. 0.W.G. — 2000 psi at 100°F.

NEW

TYPE 5520 — 600 # GLOBE TYPE 5530 — 600 # ANGLE RENEWABLE "300 BRINELL" STAINLESS STEEL SEATS "500 Brinel!" Stainless Steel Plug Discs.



Ideal for processing plants and general industrial service. Sizes: ¼" thru 2". Standard Materials: Forged carbon steel A.S.T.M. A-105 Gr. II. Alternate Trims: 18-8 Type 316 Stainless Steel; Monel. Alternate Body and Bonnet Materials: 5% Chrome, ½% Moly Steel, A.S.T.M. A-182 Gr. F-5; 18-8 Type 304 Stainless Steel A.S.T.M. A-182 Gr. F-304. Connections: Screwed, Socket Weld and Flanged Ends. 3crewed and Secket Weld Valves: For all pressures up to 600 psi at 910°F. O.W.G. — 2000 psi at 100°F. Flanged Valves: For all pressures up to 600 psi at 850°F. O.W.G. — 1440 psi at 100°F.

These 600# bolted bonnet forged steel valves really make sense to every man who knows the economy of quality valves. Designed into them are plus values that substantially reduce profit-draining production shut-downs, maintenance problems and inventory costs. Built as companions to the widely-used Type 950 Hancock 800# Steel Gate Valves, they offer: Thick, Rigid Body and Bonnet Flanges that can withstand more than ten times the rated pressure of the valve. The flanges butt — no bending, no distortion.

Re-usable Flexitallic Bonnet Gasket, in combination with the rigid body and bonnet flanges, prevents bonnet joint leakage. The gasket is a spiral-wound ribbon of stainless steel with asbestos filler and spring-like com-

pressibility. It rests in a groove in the body flange — cannot blow out even if pressures exceed ten times the rating of the valve. Hancock 600# Steel Valves are the first globe valves to use this important feature.

Maximum Use of Stainless Steel. Even the stem, swing bolts, nuts, thread bushings and packing gland followers are stainless steel — your assurance of quality that saves throughout the long life of these valves.

The 5500 Line of Hancock 600# Steel Valves is available in Globe, Angle, "Flocontrol," Lift Check and Hi-Pressure Drop designs. Whatever your needs, you can buy these valves with complete confidence in their functional perfection. Like all other Hancock Valves, they are precision engineered and carefully manu-



HANCOCK VALVES



PHONE YOUR INDUSTRIAL SUPPLY DISTRIBUTOR. His broad knowledge and experience can be of real value to you. Let him help you select the right Hancock Bronze and Steel Valves for all your service requirements.

HANCOCK VALVES

NEW

"FLOCONTROL"
TYPE 5525 — 600# GLOBE
TYPE 5535 — 600# ANGLE
RENEWABLE HARD-FACED
STAINLESS STEEL SEATS

"500 Brinell" Stainless Steel V-Port Discs.



For general industrial service. Variable orifice, shut-off and index combined in a single valve. Any desired setting can be instantly duplicated. Sizes: ¼" thru 2". Standard Materials: Forged carbon steel. Connections: Screwed, Socket Weld and Flanged Ends. Screwed and Socket Weld Valves: For all pressures up to 600 psi at 910°F. O.W.G. — 2000 psi at 100°F. Flanged Valves: For all pressures up to 600 psi at 850°F. O.W.G. — 1440 psi at 100°F.

NEW

HI-PRESSURE DROP TYPE 5505 — 600# ANGLE INTEGRAL HARD-FACED SEATS Stainless Steel Tube.

An orifice type valve, with shutoff and index in a single unit that permits the use of a smaller valve with a large capacity. Designed to withstand the terrific wrecking power of continuous blowdown. Also for use on feed-water, by-pass relief, in turbine washing processes, and where erosion is extremely severe. Size: 1". Standard Materials: Forged carbon steel. Connections: Screwed and Socket Weld Ends. For all pressures up to 600 psi at 910°F. 0.W.G. - 2000 psi at 100°F. A.S.M.E. maximum boiler pressure 970 psi.



factured. You can be sure of long resistance to wire drawing, galling, steam cutting, erosion and corrosion – for leakproof tightness month after month. They surpass the toughest service demands of process and power piping systems in the most modern refineries, petrochemical, power and industrial plants. A high degree of standardization in all sizes simplifies both maintenance and inventory needs.

Let the durability, performance and economy of Hancock 600# Steel Valves save money for you. Whether you are adding facilities, building a new plant or setting up a revalving program, get all the reasons why these tough valves serve better and longer. Complete information is yours on request.

When Hancocks go in, valve costs go down

NEW

LIFT CHECK VALVE TYPE 5540 — 600# GLOBE RENEWABLE HARD-FACED STAINLESS STEEL SEATS

"500 Brinell" Stainless Steel Piston Discs.



For general industrial service. Sizes: ¼" thru 2". Standard Materials: Forged carbon steel. Cap: Bolted. Connections: Screwed, Socket Weld and Flanged Ends. Screwed and Secket Weld Valves: For all pressures up to 600 psi at 910°F. 0.W.G. — 2000 psi at 100°F. Flanged Valves: For all pressures up to 600 psi at 850°F. 0.W.G. — 1440 psi at 100°F.

A PRODUCT OF MANNING, MAXWELL & MOORE, INC.

WATERTOWN 72, MASSACHUSETTS

MAKERS OF 'ASHCROFT' GAUGES, 'AMERICAN' INDUSTRIAL INSTRUMENTS, 'CONSOLIDATED' SAFETY AND RELIEF VALVES, 'AMERICAN-MICROSEN' INDUSTRIAL ELECTRONIC INSTRUMENTS, Stratford, Conn. 'HANCOCK' VALVES, Watertown, Mass. 'CONSOLIDATED' SAFETY RELIEF VALVES, Tulsa, Okla. AIRCRAFT CONTROL PRODUCTS, Danbury, Conn. and Inglewood, California. "SHAW-BOX" AND 'LOAD LIFTER' CRANES, 'BUDGIT' AND 'LOAD LIFTER' HOISTS AND OTHER LIFTING SPECIALTIES, Muskegon, Michigan.

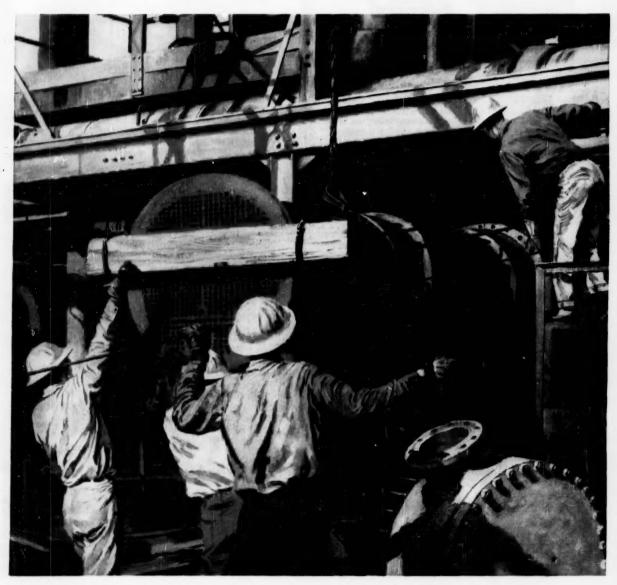
In Canada: Manning, Maxwell & Moore of Canada, Ltd., Galt, Ontario

RETUBE YOUR BUNDLES WITH

PHELPS DODGE

HEAT EXCHANGER AND CONDENSER TUBES

FOR LONG-RUN RELIABILITY!



July 1957—CHEMICAL ENGINEERING





- Wide range of finest quality copper-base alloys bi-metal combinations—to fit your application needs.
- Well-stocked, nation-wide warehouses at Houston, Tulsa, Los Angeles and Bayway, N. J.
- Experienced engineering staff at your service to help solve tube corrosion problems.

Specify Phelps Dodge . . . a leading manufacturer of tubes for the fabricators of heat exchangers and condensers!



PHELPS DODGE COPPER PRODUCTS

CORPORATION

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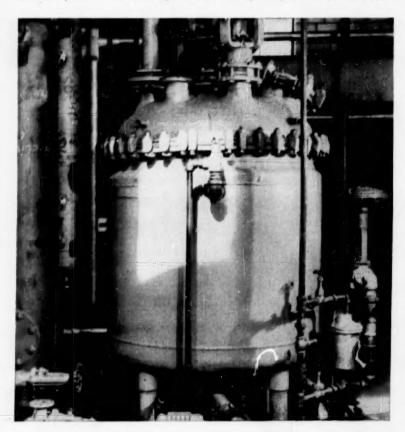
FIRST FOR LASTING QUALITY-FROM MINE TO MARKET!

EXTRA FAST DELIVERY

of standard Pfaudler stainless steel reactors now! SEE BACK COVER THIS ISSUE.

Pfaudler

.Pfaudler Corrosioneering News Published by The Pfaudler Co., Rochester, N.Y.



How Sherwin-Williams makes 1 reactor live the life of 12

To make the dye "Alkali Blue," the Sherwin-Williams Company has to handle hot, corrosive acids and harsh, abrasive precipitates.

These materials quickly eat their way through ordinary reactors-one through corrosion, one through erosion.

Sherwin-Williams used to employ cast iron kettles which lasted from six to eight months.

Then, eight years ago, they installed three Pfaudler glassed steel reactors. Those reactors are still giving full-time duty.

The original three Pfaudler reactors have already lived the life of 36 of the ordinary cast iron reactors—and they're still in service.

Glassed steel now standard

Their success with the reactors soon led Sherwin-Williams to specify Pfaudler glassed steel whenever they process flammable, volatile, corrosive chemicals.

For example, intermediates for cresol are made in three 200-gallon Pfaudler reactors and an eight-section cooler. 98% concentrated sulfuric acid and toluene course through this equipment day after day without a trace of corrosion or product contamination (glass has no catalytic or direct reaction with most chemicals).

Then, a 10,000-gallon Pfaudler glassed steel storage tank collects waste sulfuric acid at 50% concentration for reclamation.

From lab to pilot plant to production

Sherwin-Williams reports as still another advantage of Pfaudler glassed steel equipment. Because of the unusually wide line of stock standards Pfaudler carries, it's possible to use essentially the same type of equipment for a product from laboratory to pilot plant and on to fullscale production.

For more information on this line of glassed steel equipment for corrosive service, check the coupon for a copy of Bulletin 936.

Standard stainless steel reactors described in new bulletin

We've prepared a new bulletin which discusses how you can use standard stainless steel reactors in the lab, in pilot plant, and in full-scale produc-

The bulletin covers sizes ranging from 5 to 2000 gallons.

Detailed diagrams and specifications of designs cover heavy-duty drives, engineered agitation systems, rotary seals and stuffing boxes, baffles, thermometer wells, and dip pipes in a range of sizes to match each vessel.

Of the numerous types of stainless steel available, Pfaudler has standardized on Types 304, 316, 321, and 347 as offering the best all-around corrosion resistance for general process equipment. The extra low carbon grades plus full annealing of all grades, are also available, broadening the range of Pfaudler reactors for severe chemical service.



All told, there are sixteen pages of useful information in this Bulletin Number 944. If you work with reactors, it should prove an indispensable part of your file. Check the coupon for a copy.

Corrosioneering News



Pfaudler metals now run from "A"* to Zirconium

We feel that glassed steel is usually your most economical choice for corrosive service. There are applications, however, where glassed steel is not your best buy—so we maintain an arsenal of metals and alloys which you can also use where you encounter specific types of corrosion.

The latest addition to this arsenal is zirconium—a metal which has outstanding resistance to selected corrosive environments.

We've been working with zirconium for some time now, studying its virtues and its idiosyncrasies. From these studies we've acquired the experience needed to design and fabricate equipment of zirconium.

You may have seen an example of our fabrication ability at the International Atomic Exhibition where we displayed a two-gallon kettle made entirely of this metal.



With zirconium as well as glassed steel and such metals and alloys as Herculoy*, Everdur, titanium, copper, nickel, Inconel, clad materials, and stainless steel, Pfaudler offers you an impartial selection of the best material for use in your processing.

*Herculoy-a silicon-bronze alloy "A."

9:15 Technology of Glassed Steel George Warren, Ceramic Engineer

9:45 Research in Glassed Steel Gordon P. K. Chu, Research Engineer

10:30 The Corrosion Resistance of Glass D. K. Priest, Research Engineer

11:00 Designing Glassed Steel Equipment—R. H. Starrett, Chief Engineer, Elyria Division

11:40 Glassed Steel—The Production Process—G. A. Bachers, Production Manager, Rochester Division

the out-of-the-ordinary services rendered to Pfaudler customers.

As you can see from the agenda, discussion at the Seminar is centered around the use of glassed steel in combating corrosion. Other topics covered were stainless steel and alloys, ranging from pure technology to fabrication, to maintenance, to operation.

The participants also made tours of the Pfaudler plants and laboratories and took part in group discussions.

Certain of the design features you now enjoy on Pfaudler equipment germinated at one of these Seminars. We are in hopes that the one just completed will bring still further improvements in the "tools" available to you for the fight against corrosion.

For further information on the Seminar program, contact your Pfaudler representative.

CORROSION GUARANTEE

For one year after shipment, Pfaudler glassed steel equipment is guaranteed "not to become unserviceable as a result of corrosion" in terms of the operating conditions agreed upon at the time of purchase, or Pfaudler will repair or replace at no cost to the user.

Get a full year's guarantee against corrosion

Whenever you put a new piece of Pfaudler glassed steel equipment into use, you can have twelve months of guaranteed service.

If chemical attack should make your equipment unuseable during this first year under the operating conditions specified in the guarantee, we will repair or replace it without charge.

This guarantee is but one measure of the ability of Pfaudler glass to fight corrosion.

This glass is resistant to all acids except hydrofluoric, even when they're hot. It also withstands the corrosive action of all alkalies up to pH 12 up to 212° F.

The guarantee applies to all glassed steel used for reactions, fractionation, absorption, stripping, extraction, solvent recovery, etc.

14th Seminar on Corrosion counted a success

At right you see the agenda for the first of six discussion meetings of the 14th Pfaudler Seminar on Corrosion-Resisting Process Equipment which was held early in April.

These Seminars are typical of

		ER CO.	, DEPT.	CE-77	ROCHESTER	3, N. Y
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Firestone

With world-wide rubber consumption at an all-time high, Firestone, the world's largest rubber producer, planned ahead to expand production of FR-S, Firestone's new high-quality synthetic rubber. A major step in the giant expansion program is the modern Butadiene plant at Orange, Texas, to supply basic raw material. For engineering and construction, Firestone called on CATALYTIC.



JUNE 26, 1956

AUGUST 28, 1956

OCTOBER 30, 1956

CATALYTIC CONSTRUCTION COMPANY

Philadelphia 2, Pennsylvania • Toledo, Ohio



In Canada: Catalytic Construction of Canada, Limited Sarnia, Toronto, Montreal

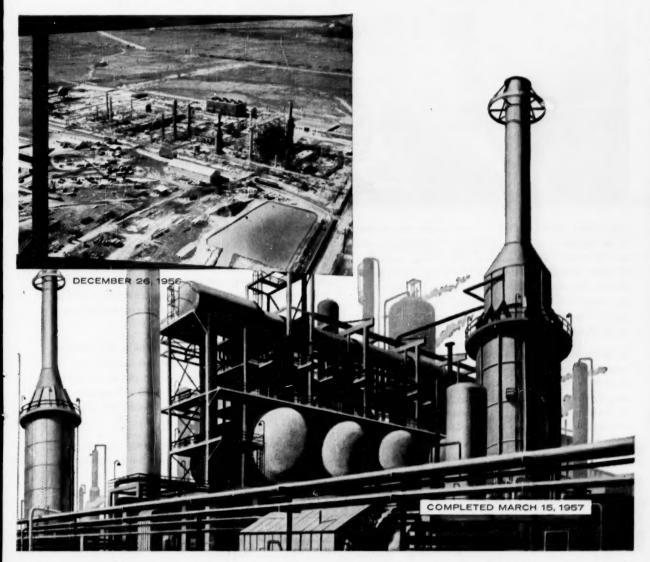


July 1957—CHEMICAL ENGINEERING

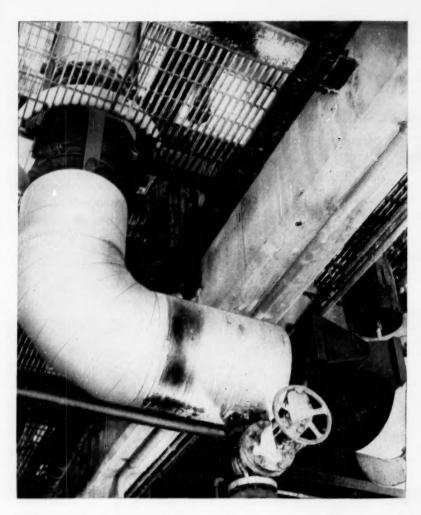
PERFORMANCE BY CATALYTIC

Construction started—June 26, 1956 Plant completed—March 15, 1957 (less than 9 months in the field)

This outstanding performance clearly demonstrates the worth of undivided responsibility which enabled CATALYTIC to complete process design, engineering, procurement and construction of this multimillion dollar facility... on time and on budget.



CHEMICAL ENGINEERING-July 1957



THIS IS WHAT

MEANS BY

SPECIAL

JOINTS

The photo shows a small but very important section of an insulated, spring-suspended 8" pipe line in the new Moundsville, W. Va., plant of the National Aniline Division of Allied Chemical & Dye Corp. At the point shown, the line is subjected to complex stresses which are completely resolved and placed in balance by the ADSCO Gimbal Expansion Joint, upper left, and the ADSCO Hinge Expansion Joint, lower right.

In the Gimbal Joint, two sets of bars are pinned to the octagonal ring at 90° to each other. The other ends of the bars, still at 90° to each other, are pinned to the pipe leading into the joint. Running through the center of the ring, with a slight clearance, is a nipple connecting two expansion elements. This gimbal arrangement permits the joint to absorb 6° of angular movement from two different directions: the left and right motion of the horizontal part of the ell and similar

motion from other unseen upper horizontal piping at 90° to the plane of the lower piping.

A partner to the Gimbal Joint and an indispensable part of this piping system is the Hinge Joint shown lower right. This absorbs the angular rotation of the ell caused by the expansion and contraction of the vertical piping.

There are so many motions involved in this section that, under certain conditions, the octagonal ring of the Gimbal Joint could describe a circle. Yet ADSCO and National Aniline engineers were able to identify all the motions and absorb them economically and efficiently by the Gimbal and Hinge Joints.

ADSCO designs and manufactures many types of both standard and special joints for many purposes. Consult ADSCO on any piping problem.

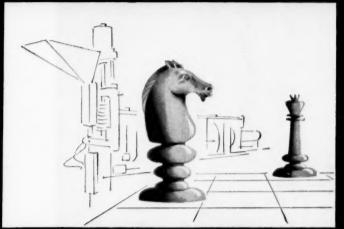
ADSCO DIVISION YUBA INDUSTRIES, INC.

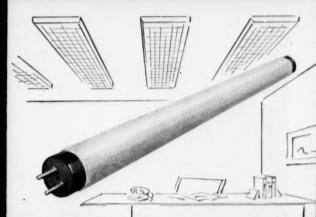
20 MILBURN ST. BUFFALO 12, N. Y.

precise PHYSICAL FORM is a problem

Mallinckrodt production techniques have often solved







Stearates in Plastics

Mallinckrodt stearates have many uses in industry. Zinc stearate is used as an internal and external lubricant in plastics and also as a flatting agent in lacquers. Magnesium stearate is an efficient mold-releasing agent for plastic items. Calcium stearate is a lubricant and stabilizer in plastics and also improves the plasticity of starch-clay coated papers. Gelling characteristics of aluminum stearates are important in manufacturing greases . . . and in paints they increase pigment suspension without making the paints too thick for easy application.

Chemicals for Electronics

The ability of Mallinckrodt research and production chemists to control purity and maintain uniformity of dibasic calcium phosphate and other chemicals needed to manufacture phosphors has played an important part in the development of the fluorescent lamp industry. Mallinckrodt Standard Luminescent chemicals are also used extensively in producing television phosphors. Mallinckrodt TransistAR® chemicals are used in the manufacture of transistors and other semi-conductor devices.

Your particular application of these and other Mallinckrodt industrial chemicals may be different. Drop us a note on your requirements you might be better served by Mallinckrodt.



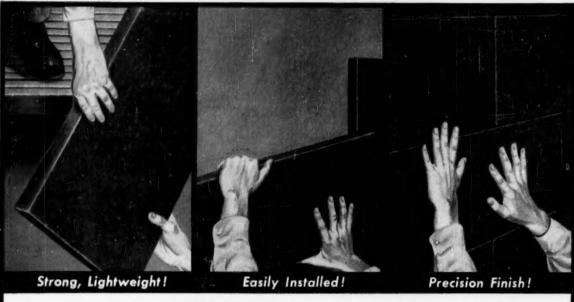
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A TRUE-CUT BLOCK WITH PRECISION-FINISH!

EAGLE-PICHER PV SUPERTEMP **BLOCK INSULATION**



- · Eagle-Picher's "precision-finish" is one of the most important insulation developments in years.
- Highly efficient, all-purpose block that is practically dustless.
- Great structural strength! Meets rigid demands for long-lasting block able to withstand wide temperature range up to 1900 F.
- Lightweight, easily installed! Easily cut to fit irregular areas-no special tools needed. Requires only minimum reinforcing.
- Effectively resists steam and other moisture! Does not disintegrate or lose thermal efficiency under heavy duty service.

Eagle-Picher produces a complete line of industrial insulations for all temperatures from below Zero to over 2000 F.

FREE SAMPLE!

Write Today!

Eagle-Picher PV Supertemp Block conforms to Commercial Standard CS 117.

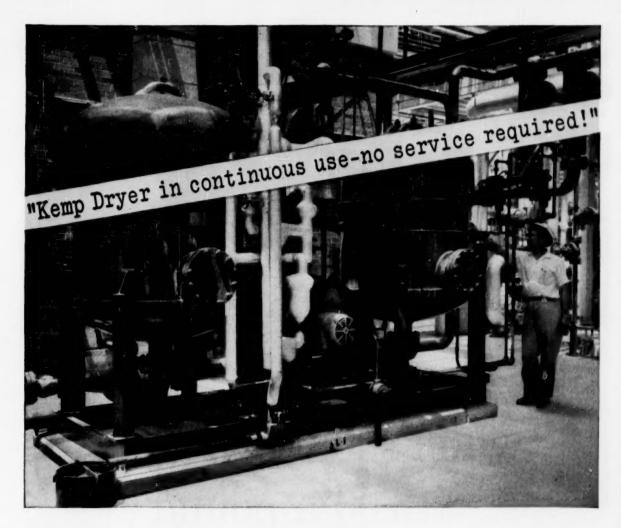


Since 1843

EAGLE-PICHER

The Eagle-Picher Company . General Offices: Cincinnati 1, Ohio

(Member of Industrial Mineral Fiber Institute)



Cities Service Petroleum reports:

Kemp Dryer in continuous operation 7 days a week; has required no service or downtime!

To dry compressed air for instruments in a hydroformer unit at its refinery in Lake Charles, Louisiana, Cities Service Refining Corporation has installed a Kemp Model LC SE2 Air Dryer. Since January, 1955, it has served continuously—seven days a week—drying 1900 cubic feet of air per minute to a dew point of -10° F.

This fully automatic Kemp Dryer, reactivated every 12 hours (or 22,800 cubic feet of air), has so far required no downtime or service at all! And, according to Mr. Glendon L. Smith, Unit Engineer at Cities Service, there is practically no pressure drop from the entering pressure of 285 pounds . . . further indication of Kemp quality and efficiency.

Kemp Dryers for Every Purpose

Kemp offers a variety of dryer models to meet all problems. Designed to dry air, gases or liquids to sub-zero dew points at low cost, they are constructed of quality materials and embody the engineering knowledge gained from Kemp's many years of experience. They are available with manual, semi-automatic or fully automatic tower reactivation. In addition, Kemp will prescribe the proper desiccant for each specific drying job. If you have a problem involving the removal of water from air, gases or liquids, contact Kemp now. For complete facts and technical information, write for Bulletin No. D-100.

KEMP OF BALTIMORE



DYNAMIC DRYERS

CARBURETORS - BURNERS - FIRE CHECKS METAL MELTING UNITS - INERT GAS GENERATORS SINGEING EQUIPMENT

THE C. M. KEMP MFG. CO. 405 East Oliver Street, Baltimore 2, Maryland



when should you pay \$13.00*a pound for TITANIUM?

The answer is when its cost/life ratio makes titanium less costly than other metals—as it often does. Look at it this way...

More Metal Per Pound—Titanium weighs only 56% as much as steel of the same strength. Where 50 pounds of steel is needed—28 pounds of titanium will do the job.

It's Final Cost That Counts—Fabricating takes the lion's share of production costs on most jobs. Considering material and fabricating costs together usually whittles down the titanium price differential to 2 or 3 to 1. And, most important . . .

REM-CRU TITANIUM

MIDLAND, PENNSYLVANIA

Titanium Outlasts Most Metals—even those generally considered 'corrosion-resistant,' by 10, 20, even 50 times or more.

Added together, these facts often make titanium the most inexpensive material you can use. And only titanium can provide its exceptional combination of *light-weight*, *high-strength*, and *resistance to corrosion*. Ask a REM-CRU engineer to give you complete details about what titanium can do for you.

*The actual cost of titanium mill products varies with the grade, size and quantity ordered. The \$13.00 figure is representative of today's prices for items used in commercial applications.

Write Dept. C-7 for the Rem-Cru Review-a free periodical presenting the latest data on titanium.

World's Most Versatile Metal

Sales Offices: 6033 East Bandini Boulevard, Los Angeles 22, California • 4501 W. Cortland Street, Chicago 39, Illinois • 405 Lexington Avenue, New York 17, N. Y.

Attalla CNI



FOR INDUSTRIAL and CHEMICAL PROCESS PLANTS and plumbing installations





Whips Coursion



Since 1928 Attalla C N I has been whipping the corrosive effects of caustic, brine and concentrated sulphuric acid as well as many other destructive liquids and gases.

Attalla C N I's inherent properties of strength and resistance to corrosion and erosion make the use of expensive high alloys unnecessary in many industrial applications. The test of time has proven the performance, economy and durability of Attalla C N I.

Because of C N I's resistance to caustic and acid atmospheres, Streed Products Corporation, Gadsden, Alabama, has chosen Attalla C N I castings for their lap joint back-up flanges in stainless steel pipe fabrications. Fifty percent stronger than ordinary cost iron, Attalla C N I gives this new flange more than adequate strength in addition to its corrosive resistance.

Write to our engineering department for further information and let them tell you of the many uses of Attalla C N I and its application to your specific problem.

*CNI

MEANS CAST CHROME NICKEL IRON ALLOY

ATTALLA PIPE AND FOUNDRY COMPANY, Inc.

O Bas 211 Telephone 221
ATTALLA, ALABAMA

your best investment for the LONG-HAUL...



STEPHENS-ADAMSON CARRIERS

Compare before you buy . . . check the many outstanding features of S-A Carriers. You'll be pleasantly surprised to find out how economical these "top-quality" units are to install and maintain . . . in fact, it will cost you more to settle for anything less than STEPHENS-ADAMSON Carriers. Stocked for immediate delivery. Available in roller angles of 20°, 35°, and 45°, roller diameters of 4", 5", and 6", and for belt widths up to 60"

S-A QUALITY FEATURES THAT ASSURE DEPENDABLE FULL-CAPACITY CONVEYING

- SPUN END, ONE-PIECE ROLLERS . . . consisting of carrying surface and ends spun from a single piece of heavy gauge steel tubing plus an inner bearing tube welded to the spun ends.
- PERMANENTLY SEALED . . . precision ball or roller bearings are protected by a die cast labyrinth seal that will not corrode or wear . . . grease stays in, dust and dirt stay out.
- PRE-LUBRICATED... sufficient grease to last the normal life of each carrier is sealed into
 each roller at the factory. Alemite fittings also provide for easy re-lubrication if necessary.
- QUICK-CHANGE ROLLER... pre-adjusted rollers easily slide in or out of the hex slots in the end plates... provides fast roller changes without the use of tools.

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Proc	ducts items	, send this co	upo	n to	day.	

- CARRIER CATALOG NO. 355
- CATALOG NO. 60
- HAVE REPRESENTATIVE CALL

NAME____TITLE____

ADDRESS....

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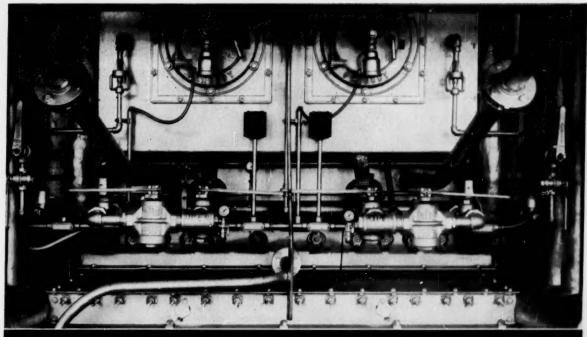
Standard Industrial Products

STEPHENS-ADAMSON offers a complete line of "in stock" bulk material handling products. They are ready far immediate shipment from the S-A distributor in your area. For information, request Catalog No. 60.

STEPHENS-ADAMSON

3 Ridgeway Ave.

Aurora, Illinois



controlling gas to furnaces and boilers...

AN IMPORTANT JOB DONE BY

HOMESTEAD Lubricated PLUG VALVES

AT A. B. DICK COMPANY, CHICAGO

An analysis of numerous types of valves convinced the A. B. Dick Company that HOMESTEAD Lubricated PLUG VALVES were well suited for use on gas lines to furnaces and boilers in their Chicago, Illinois plant. In fact, there are more than 5,000 Homestead Valves of various types in this plant. Satisfactory performance from the valves they have chosen is guaranteed by built-in features such as:

- 1. 100% Pipe Area—streamlined ports—minimum resistance to flow—minimum pressure drop.
- 2. Controlled Pressurized Lubricant System prevents sticking, by instant piston-like movement of plug at start of lubrication.
- Extruded lubricant around stem indicates system is full; serves
 as stop signal to prevent overlubrication. No clogging of low
 pressure lines with lubricant, fouling of meters, orifices, etc.
- Triple Head Seal—two rings of lubricant and reinforced Teflon stem seal. Stem seal holds pressure even without lubrication.

. . . plus many others. To know the meaning of real valve economy and service, install a few of these valves under your own service conditions. You'll be glad you did.

Your copy of Valve Reference Book No. 39-5 showing Homestead Lubricated Plug Valves will be sent on request.



Please mail, withou Valve Reference Bo No. 39—Section 5.	
Name	Title
Company	
Address	
City	State
MANY	



OMESTEAD VALVE MANUFACTURING COMPANY_____

P. O. BOX 13

Serving Since 1892

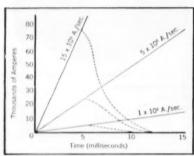
CORAOPOLIS, PA.



Type FB-20 single pole circuit breaker; 2000 amperes continuous, 1000 volts d-c.

NEW "FB" CURRENT LIMITING CIRCUIT BREAKER

Now...complete current limiting protection against fault currents of 1000 to 150,000 amperes



Peak let-through current for FB circuit breaker with 1000 ampere trip.

Small in size, these FB d-c circuit breakers with fast current limiting action provide a tremendous protective capacity. In the event of a fault, powerful springs open the contacts before the current has a chance to rise to its maximum potential.

Even in circuits where the rate of rise might approach 15,000,000 amperes per second, let-through current will not exceed 80,000 amperes. In most applications, it will never exceed 30,000 amperes—and total interrupting time is only 12 milliseconds. This quick action reduces the magnitude and duration of fault currents—thus eliminating mechanical failures and heat damage.

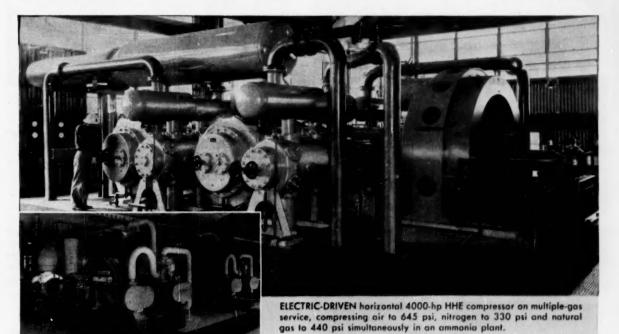
FB circuit breakers are available in either single or double pole models and with continuous current ratings of 1200, 2000, 3000 and 5000 amperes and up to 1000 volts d-c. They are available with either station-

ary or drawout mounting. Write for Bulletin 3004-A. I-T-E Circuit Breaker Company, Switchgear Division, 19th & Hamilton Sts., Philadelphia 30, Pa.

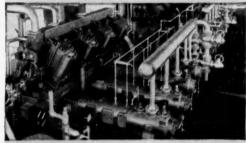
I-T-E CIRCUIT BREAKER COMPANY • Switchgear Division

IN CANADA: EASTERN POWER DEVICES LTD.

GOOD COMPRESSOR for PROCESS WORK?



STEAM-DRIVEN compressors with non-lubricated cylinders handling hydrogen chloride gas at 54 degrees below zero.



GAS-ENGINE compressors with non-lubricated compressor cylinders on hydrogen recycling duty at a Southern refinery.



CENTRIFUGAL compressors on ethylene refrigerations these are tandem units driven by steam turbine.

In process jobs, any interruption of the cycle often means large loss of production, expensive repairs, and introduction of hazardous conditions. In manufacturing compressors for these jobs, there is one ingredient most vital.

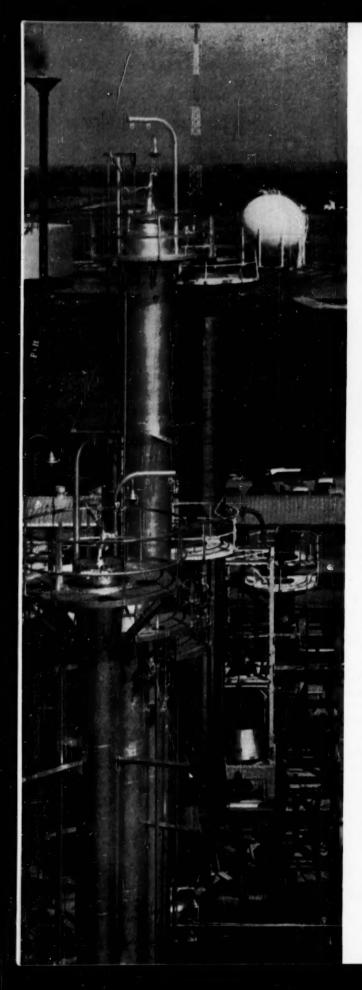
That ingredient is knowledge. The compressor manufacturer must know how to predict conditions in the process which might force a shutdown, and must know how to meet those conditions with a compressor which will minimize the possibility of a shutdown.

Such knowledge is obtained only through years of actual experience in designing, building and applying compressors for all sorts of processes, for handling all kinds of gases, and for any range of pressures.

Ingersoll-Rand has more of that kind of experience than any other compressor builder. For information on process compressors for pressures up to 35,000 psi, contact your I-R representative or write direct. Ask for your copy of Form 3132A.

Ingersoll-Rand
11 Broadway, New York 4, N.Y.

COMPRESSORS . GAS & DIESEL ENGINES . PUMPS . AIR & ELECTRIC TOOLS . CONDENSERS . VACUUM EQUIPMENT . ROCK DRILLS



This Sweco-built refinery addition helped an Indiana plant pull from behind to a front position in the race to upgrade gasoline.

High Octane Package Handled with Care

Like many refineries, the Mt. Vernon plant of the Indiana Farm Bureau Association was caught with its rating down when the latest high octane race started. That was before Sweco wrapped up a \$1,500,000 refinery package that included a 3,000 BPSD platformer, a 2,100 BPSD unifiner, and a new steam generating plant with an hourly capacity of 120,000 lb. of high-pressure steam.

Off and running

The platformer-unifiner team went on stream in November, 1956, and has been in continuous operation ever since. This combination unit, built under license from Universal Oil Products Company, makes Mt. Vernon a front runner in today's race to upgrade gasoline.

In planning the steam generating plant, Sweco engineers decided to save time by specifying the equipment and letting bids for fabrication. But outsiders couldn't meet the cost estimates or contract, so Sweco built the pressure vessels in its Los Angeles plant. They were delivered three days ahead of schedule.

Problems in stride

Heavy spring washouts and a tight budget were just some of the problems the Sweco engineering and construction crews took in stride. Designing and building moderate-size refinery installations is their specialty.

This is the kind of service, the extra service Sweco clients in the process industries expect. Large or small, at home or abroad, it's the only kind they get... in the engineering and construction of refineries (Sweco is licensed to build plants for practically all major refining processes), chemical plants and ore beneficiating mills... in the design and manufacture of process equipment such as heat exchangers, steam jet ejectors and distillation columns... in a full line of vibrating screen separators.

Write today for our new brochure on how Sweco products and services can help meet your processing needs. Ask for brochure E-2-32.



Southwestern Engineering Company

4800 Santa Fe Ave., Los Angeles 58, Calif.

Mister, you're looking at a panelboard that's really built for <u>Heavy Duty!</u>



QMB Saflex Distribution Panelboard

Here's a panelboard that's built for the tough jobs! But it goes a lot further than rugged construction. It's designed with plenty of space for easier wiring and maintenance.

The heart of this QMB Saflex Distribution Panelboard is the quick-make, quick-break, horsepower rated switch unit.

It's loaded with features-

- Each switch unit individually enclosed in heavy gauge steel
- Dead front construction
- Heavy duty cast operating handle
- Double-spring mechanism insures positive opening under full load
- Visible blades for maximum safety
- Positive pressure fuse clips and switch jaws assure
 maintenance-free connections
- Cover interlock prevents unauthorized access but makes normal maintenance easier

Write for...

Bulletin S D-29 for further information Address: Square D Company, 6060 Rivard Street, Detroit 11, Michigan



NOW...EC&M PRODUCTS ARE A PART OF THE SQUARE D LINE!

SOURKE D COMPANY



News about COATINGS for METALS

Metallic......Protective......Protective

Phenolic linings improved for tank use

Reports show Unichrome Plastisols give record service

Unichrome Plastisols, which produce thick vinyl coatings, are withstanding conditions that rapidly deteriorate unprotected metals or other materials. To illustrate:

Plastisol coated ducts exhausting strong acid fumes show no deterioration after 4 years.

After 6 months service, plastisol coated agitators for chemical mixers show absolutely no wear. Rubber coatings, used previously, started to fail after only one month.

Plastisol coating on a 5-ft. bubble tray at bottom of a 60-ft. scrubbing tower has been withstanding acid fumes and caustic solutions for over 2 years now.

A report shows Unichrome Plastisol Coating on racks withstood 6 years of daily use in corrosive plating and cleaning solutions.

APPLICATION NO PROBLEM

Unichrome "Super 5300" Coating spray-applies seamless films as thick as sheet linings. It delivers up to 60 mils per coat. "Series 4000" Plastisols apply by dipping, slushing, troweling or other convenient means. Send for Bulletin VP-2 or name of the nearest applicator of Unichrome Plastisols.

Unichrome is a trademark of Metal & Thermit Corp



General Offices: Rahway, New Jersey
Pittsburgh • Atlanta • Detroit
East Chicago • Los Angeles
In Canada: Metal & Thermit—United Chromlum
of Canada, Limited, Rexdale, Ont.

Unichrome Series B-124 Linings give reliable protection — are now being applied by specialists



Ingenuity! Lithcote Corp., a prominent applicator of Unichrome Phenolic Coatings, has adapted a former railroad roundhouse to line tank cars. Cars are sprayed, switched to the baking facilities, and can then be sent rolling back to the customer in short order.

Phenolic-type coatings, the acknowledged "workhorse" for tank lining applications, have a long and successful record in corrosive service. They'll be specified even more now that two problems have been overcome by Metal & Thermit.

(1) Unichrome Phenolic Coatings have been developed that assure more uniform linings, greater impact resistance, and improved protection. (2) Experienced, independent applicators across the country now make it possible to ship large equipment to the nearest specialist, get fast service, save on transportation.

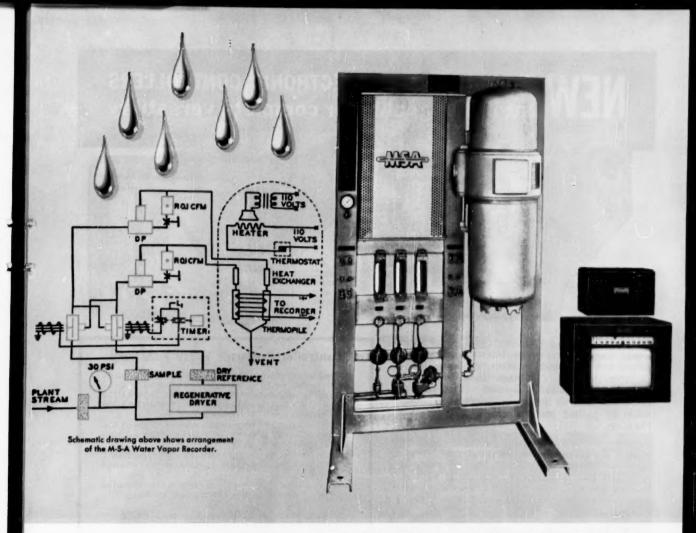
UNIQUE PHENOLIC COATINGS

Several pigmented materials in the Unichrome B-124 Coatings group give 2-mil thicknesses per dry coat. This is twice that of ordinary phenolic coatings. Fewer coats are needed. Clear coatings in the group bake into a hard, smooth film for an easyto-clean top coat.

BUILT-IN CONTROL

Unichrome Coating B-124-17 is a widely specified phenolic formulation that is gray when wet, olive drab when fully cured. This cure-control offers reliable visual inspection of a job well done. It is valuable for avoiding undercuring in large tanks and tank cars due to uneven heat application.

Details on these Unichrome Linings are given in Bulletin Chem-C-2. Contact Metal & Thermit also for names of nearest applicators of Unichrome Series B-124 Linings.



The M-S-A Water Vapor Recorder operates on a new principle, based on measurement of the heat energy exchanged when a gas is adsorbed on or desorbed from the surface of a solid adsorbent.

M-S-A[®]Continuous Water Vapor Recorder detects trace moisture in air or gas streams

The M-S-A Water Vapor Recorder is an extremely accurate instrument which can solve a great number of moisture problems occurring in process industries as well as gas pipelines.

This unit continuously records low concentrations of water vapor in air or gas streams, and analyzes in the range of 0 to 10 up to 0 to 5000 ppm. It's particularly effective for monitoring natural gas in pipelines, thus avoiding undesirable moisture conditions. Of further value is the instrument's ability to maintain the efficiency of drying towers by monitoring effluent gases. This per-

mits regeneration to begin just before or immediately upon the first water break-through.

This newly developed instrument is useful, too, for preventing moisture damage to process catalysts by monitoring feed streams, and for the detection of small amounts of water, so critical in controlling corrosion.

Typical applications for this dependable instrument include measurement of water or water vapor in streams containing: LPG, Ethylene, Natural Gas, Freon, Naphtha and other feed stocks. Write for our free bulletin for further information.

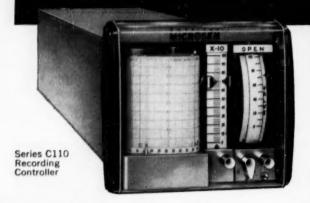


INSTRUMENT DIVISION

MINE SAFETY APPLIANCES COMPANY

Pittsburgh 8, Pennsylvania
At your service: 76 Branch Offices in the United States

NEW TRANSISTORIZED ELECTRONIC CONTROLLERS Interchangeable for complete versatility





The new 'American-Microsen' Series C100 Electronic Controllers can be interchanged at the panelboard in seconds. A recording controller to an indicating type...a proportional-action controller to proportional-plus-reset...slow reset to fast reset—any of these replacements is quickly made by pulling one unit out and plugging in the other.

The controller settings of the 'American-Microsen' System are all calibrated and repeatable. When a controller station is replaced, the proportional, reset and rate settings can be made in advance so the process is on control the instant the change-over is completed. No playing around to tune in the control.

When the process is on manual control during a replacement operation, the controller station stays in balance with the actual valve position. Thus the process can be changed back to automatic control without "bumping" or upset. A unique feature of the 'American-Microsen' System eliminates any "balance" or "seal" position between manual and automatic.

These are but a few of the many functional advantages of the new 'American-Microsen' Electronic Control System. Join the many satisfied users of this new approach to process control. Make certain you have the better control and simplified servicing so essential to higher product quality and greater operating economy. Arrange for a meeting with one of our sales engineers to determine the best equipment for your service. Write for Bulletin RC100.

Controller Performs These Functions

Measures input signal from transmitter and records or indicates in terms of the measured variable pressure, temperature, flow, etc. (The Series C110 records on a 3-inch wide strip chart, the Series C120 indicates on a 4-inch diameter scale.)

Provides means of setting the desired value of the measured variable (set point) and compares actual value with desired value.

Transmits control signal, incorporating proportional, reset, and/or rate actions to operate final control element.

Provides means to operate control element manually with simple switch and manual knob.

Ultra-Modern Features Provided

All functions of recording (or indication), controlling (proportional, reset, and/or rate), and manual valve operation in a single housing.

Transistorized controller station for ultimate reliability and long service life.

Printed circuitry and miniaturized components for space-saving simplicity.

Plug-in units for complete interchangeability and ease of maintenance.

Ratio, cascade, and other similar control arrangements, using standard instruments.

Direct bumpless transfer from manual to automatic control with no intermediate position.

DC signals of 1.0 to 5.0 milliamperes for instantaneous distance transmission up to 30 miles.

Controllers are compatible with any unit of other manufacture using the standard 1 to 5 milliampere DC signal.

MANNING, MAXWELL & MOORE, INC.



INDUSTRIAL CONTROLS DIVISION . STRATFORD, CONNECTICUT

MAKERS OF 'AMERICAN-MICROSEN' ELECTRONIC INSTRUMENTS FOR MEASUREMENT, TRANSMISSION AND CONTROL



TANK CARS specially lined or custom built to your requirements for safe, economical movement of chemical products.

REPAIR SHOPS strategically located for fast, continuous maintenance of all cars leased to shippers and railroads.



BRANCH OFFICES in market centers staffed by transportation specialists who stand ready to help you overcome your shipping problems—anytime.

FIFTY YEARS of shipping experience gained in serving the fast growing chemical industry.

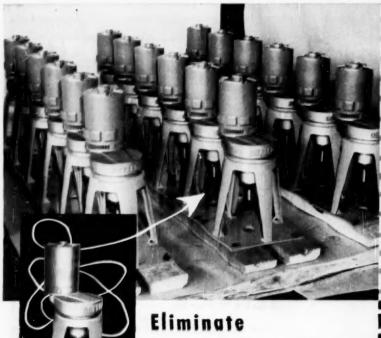
NORTH AMERICAN

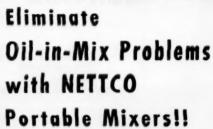
NORTH WESTERN REFRIGERATOR LINE COMPANY
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231 South La Salle Street, Chicago 4, Illinois

A NATIONWIDE ORGANIZATION WITH BRANCH OFFICES IN IMPORTANT MARKET CENTERS

DALLAS . FOND DU LAC . ST. PAUL . ST. LOUIS . TULSA . SAN FRANCISCO . NEW YORK





The DRIP-PROOF CONSTRUCTION of Nettco Portable and Flange-Mounted Mixers typifies the many advanced design features developed and perfected at Nettco to bring you long lasting, low cost "engineered agitation". Benefit from the application versatility of these feature-packed units . . . with standardized components engineered to increase productivity, lower power costs, and minimize maintenance requirements.

Here's what FEATURE-PACKED means:

Drip-proof construction . . . ideal for food and pharmaceutical applications

FLANGE MOUNTED

- High speed (1800 RPM) and medium speed (420 RPM) designs
- Standard HEMA Vertical C Flange Motors (standard speeds, ½ th to 2 HP)
- Open, totally enclosed, and explosionproof motor constructions
- Designed for portable, open tank, or closed tank installations
- Universal bracket clamp permits "anyangle" shaft positioning to suit needs
- Top efficiency drive (more propeller power per given HP input)
- Oversized bearings for full radial load carrying capacity
- Converts in field . . . portable to flange mounts . . , high to medium speeds
- Quick shaft interchange due to exclusive split coupling . . . accurate alignment, positive grip, no shaft scoring

For the ultimate in "Engineered Agitation", send your process specifications to NETTCO for recommendations. Request free DATA

SHEETS from New England Tank & Tower Co., 87 Tileston St., Everett 49, Massachusetts.



RETTCO
ENGINEERED AGITATION SPECIALISTS

ENGINEERED AGITATION

PORTABLE

PIPELINE-FLOMIX

SIDE ENTERING

Standard NETTCO units available in 1/3 to 30 HP sizes—offering a variety of speed reduction designs, motor mounts, stuffing box modifications, etc., in alloys to suit proc-

ess conditions. Bulletin No. 532.

TANK TOP

Model WT (Ratios from 3.5:1 to 68:1); Model T (Ratios from 6.25:1 to 100:1) — Feature clean, efficient designs with minimum moving parts. Variety of motors, shafts, stirrers, and supports furnished to meet specific needs. Bulletin No. 551.

PIPELINE-FLOMIX®

Exclusive NETTCO design for continuous pipeline mixing, increased product uniformity, simplified piping layouts, etc. Suitable for high capacities, pressures, and temperatures. Request

Bulletin No. 531 for complete data.



Please send me the following literature:

- ☐ Tank Top Agitators Bulletin 551
- Portable & Tripod Mixers Specification
- ☐ Pipeline-Flomix® Bulletin 531
- Side Entering Bulletin 532



ALCOA RIGID CONDUIT IS EASIER AND MORE ECONOMICAL TO INSTALL, SAY CONTRACTORS

The contractors who installed the electrical system in Alcoa's 30-story office building and in every new Alcoa plant erected in the past ten years agree on this point.

Aluminum rigid conduit installs easier, faster and at lower cost than any other!

Alcoa® Aluminum Electrical Rigid Conduit is easier to cut . . . easier to bend . . . easier to thread.

It weighs two-thirds less than steel . . . which makes it easier to handle, less costly to ship, easier to stockpile at job site.

From the long-range viewpoint, there are other savings:

No staining or corrosion . . . and no painting

Up to 20% less voltage drop

Greater safety in hazardous locations . . . because aluminum is nonsparking

Alcoa Rigid Conduit has Underwriters' Laboratories approval. Suitable fittings are available. And adequate stocks are maintained throughout the country by Alcoa distributors.

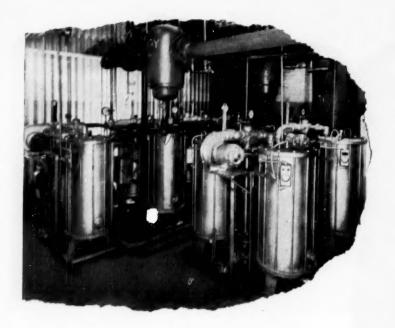
Why not get all the facts on this timesaving, more profitable conduit? The coupon below will bring you complete literature and a generous sample.





ALCOA · CONDL

Aluminum Company of America 2324-G Alcoa Building
Pittsburgh 19, Pa.
Please send literature on Alcoa Aluminum Electrical Rigid Conduit and a one-foot sample.
Name
Title
Company
Address
City and State



These three Lectrodryers* feed a constant flow of CLEAN, DRY air to 125 dryboxes where electronic components are assembled at Texas Instruments, Incorporated, Dallas, Texas.

DRYness surrounds, and is hermetically sealed inside of germanium and silicon transistor rectifiers and diodes assembled here. No moisture to impair their dependability!

DRYing clears the atmosphere for Crystal Gozers



2% relative humidity or less is the DRYness of air fed to these dryboxes. Three Lectrodryers do that DRYing—continuously, economically.

Is moisture bothering your present processes or are you planning for the future? To learn what DRYing will do for you, write Pittsburgh Lectrodryer Division, McGraw-Edison Company, 303 32nd Street, Pittsburgh 30, Pennsylvania.

Lectrodryer

U.S.I. CHEMICAL NEWS

A Series for Chemists and Executives of the Solvents and Chemical Consuming Industries

Variety of Plastics Helps New Pump Lick Corrosion

Except for its drive motor, a new pump designed for electroplating and chemical service is made entirely of plastics. Six distinct kinds of plastic materials are used in its various components.

The pump body is made of polyethylene, the impeller of Hypalon. The filter and filter chamber utilize polyvinyl chloride, Dynel and a phenolic, while the hose is of vinyl. The pump handles from 50 to 300 gallons per hour, and, the manufacturer says, filters out all particles larger than about 1 micron. The plastics are said to take in stride such materials as chromic, fluoboric and nitric acids, and the filter successfully handles solutions of ferric chloride, silver nitrate, iron and lead fluoborate and many others.

Test Detects Trace Ethanol

A simple procedure for detecting trace amounts of ethanol in liquids has been developed and reported in the literature. It is especially sensitive when used with liquids that are free from water.

that are free from water.

The test first oxidizes ethanol to acetaldehyde and then permits detection of the latter by reaction with nitroprusside. As little as 3 micrograms of ethanol in one drop of a benzenethanol mixture can be easily detected. Presence of water in the test liquid results in hydration of some of the acetaldehyde and thereby decreases the sensitivity of the test.

One to three drops of the sample are placed in a micro test tube, and several centigrams of hot copper wire or cupric oxide are dropped into the tube. A disc of filter paper moistened with one drop of a freshly made reagent (consisting of equal volumes of 5% sodium nitroprusside solution and 20% aqueous morpholine solution) is placed over the top of the test tube. If ethanol is present, a deep to light blue stain appears on the paper almost at once.

Tank for Nuclear Reactor Fabricated Entirely of Zirconium Alloy

A new experimental nuclear power reactor utilizes a tank fabricated entirely of Zircaloy-2. The complex assembly illustrates how conventional fabricating techniques can be modified to permit the use of zirconium and its alloys.

Because zirconium is highly reactive at high temperatures, welds of the metal and its alloys must be shielded against air. This shielding was achieved with a water-cooled apparatus specially designed to fit the spherical and conical shapes of the welded surfaces. The apparatus also directed inert gas at and behind the torch.

Nat'l Distillers Changes Name To Reflect Growth of Activities In U. S. I. Chemical Division

Now National Distillers and Chemical Corporation; U.S.I. Head Made an Executive V.P.; Third of 1956 Profits from Chemicals

National Distillers Products Corporation has changed its name to National Distillers and Chemical Corporation.

The new corporate title reflects the substantial growth of the company's chemical operations, which last year contributed 34% of operating profits before interest, taxes and minority interest.

ATTENTION: Users of Taxfree And Specially Denatured Alcohol

Users of specially denatured and taxfree alcohols who are in the process of filling out forms for renewal of their basic and withdrawal permits should note that U.S.I.'s parent company has changed its name (see story, next column).

When you file your applications with the Assistant Regional Commissioner— Alcohol and Tobacco Tax Division. please be sure to use the new company name, U.S. Industrial Chemicals Co., Division of National Distillers and Chemical Corporation. National entered the chemical field in 1950 when it built a sodium plant at Ashtabula, Ohio. This operation is now a part of the U. S. Industrial Chemicals Co. division, acquired by the parent company in 1951. Today, all chemical activities of the corporation are conducted through its U.S.I. division and its subsidiary, National Petro-Chemicals Corporation.

Elect New Officers

Coincident with the name change, John E. Bierwirth, president of the corporation, announced the promotion of a number of key executives. Among these were Dr. R. E. Hulse, Roy F. Coppedge and B. C. Ohlandt, who were elected executive vice president in charge of the U.S.I. division, with responsibility for all

New Officers at National Distillers - U.S.I.

Dr. R. E. Hulse, new Executive V. P. of National Distillers and General Manager and V.P. of U.S.I. Division, directs Corporation's chemical operations. He joined National in 1949 as Director of Research and Development. William P. Marsh Jr., Assistant General Manager of U.S.I. Division and V.P. of National Distillers, has been named U.S.I. V.P. as well. Dr. Stuart Schott, with National since 1945, is new Research V.P. of U.S.I. Francis Olmsted heads the Development Department as a U.S.I. V.P. Alden R. Ludlow, Jr. joined company in 1934, has now been made U.S.I. Sales V.P. R. H. Cornwell was appointed U.S.I. V.P. of production, and is in charge of all U.S.I. and National Petro-Chemicals plants.



R. E. Hulse



W. P. Marsh, Jr.



S. Schott



F. Oimsted



A. R. Ludlow, Jr.



R. H. Cornwell

U.S.I. CHEMICAL NEWS

U.S.I. "Chemical News" Marks 25th Anniversary

Has Largest Circulation of Any **Publication in Chemical Industry**

With this issue, U.S.I. "Chemical News rounds out 25 years of service to the chemical processing industry. Today, "Chemical News" is the most widely circulated medium of its kind in its field. It is regularly inserted in all leading U.S. chemical periodicals, and in addi-tion has substantial distribution by mail. Combined circulation is over 320,000.

Attracts Many Inquiries

The high degree of interest in "Chemical is reflected both in inquiries and in readership ratings, and last year it brought thousands of inquiries about the products and services mentioned in its columns. And it consistently gets the highest advertising readership ratings in publications where it appears.

One reason for this sustained interest is



The first U.S.I. "blue sheet"-June, 1932. The name was later changed to "U.S.I. Chemical News' to reflect the expanding activities of the company.

that "Chemical News" does not confine its columns to information about products of U.S.I. Considerable space is devoted to items about products of other manufacturers, to research findings and to processing technology. In short, "news value" is the editorial

The Technical Developments column, a regular feature of page 2, describes new products and processes that range across the entire industry. Manufacturers who have something new to tell their prospects can take advantage of this column by writing the Editor.

Would You Like to Get "Chemical News" by Mail?

If you would like to make sure you see every issue of "Chemical News" you keep a permanent file of them, as many readers do, ask to be put on the mailing list. Just write Editor, U.S.I. Chemical News, U.S. Industrial Chemicals Co., 99 Park Ave., N. Y. 16, N. Y.

New Polyethylene Squeeze **Tube Keeps Original Shape**

A new kind of squeeze tube has been developed. Made of polyethylene, it looks just like the familiar collapsible metal tube, but snaps back to its original shape after being squeezed to dispense part of its contents. In so doing, internal pressure is lowered and excess material at the mouth of the tube is sucked back inside. Advantages include less waste and no hardening or drying out of the tube contents.

CONTINUED

Name Change

chemical activities of the corporation. Both Dr. Hulse and Mr. William P. Marsh Jr., U.S.I. Assistant General Manager and a Vice President of National Distillers, have been named Vice Presidents of the U.S.I. Division.

Four other executives were appointed U.S.I. ice presidents. They are: Robert H. Cornwell, who is in charge of production; Alden R. Ludlow, Jr., sales; Francis Olmsted, development; and Dr. Stuart Schott, research.

TECHNICAL DEVELOPMENTS

Information about manufacturers of these items may be obtained by writing U.S.I.

A non-corrosive leak detection paint is reputed to be effective in quickly spotting fissures to 0.001 in. dia. in assemblies, systems, tanks, etc. Ammonia works a color change at fissure. Paint is easily washed or wiped off. No. 1240

A tributyltin exide to control microbiological slime in pulp and paper mill systems is reported highly successful under all pH conditions. Also non-corrosive, low in toxicity, and very economical.

No. 1241

A spray-on sign cleaning "solute" is offered as compatible with water of 0-50 grain hardness, fast-acting, simple to rinse off, and harmless to steel, point, and personnel. Cost claimed 1s per sq. ft. cleaned.

No. 1242

Another radioactive carbon-14 compound joins available uniformly and specifically labelled radioactive amino acids. Uses are expected in the study of biological systems and amino acid formation and metabolism.

No. 1243

Updated activated carbon solvent recovery systems are said to recover numerous solvents at a very economical cost. They also appear to in-crease both process efficiency and employee

Detergent concentration is constantly controlled over a narrow range by a unique controller using neither vacuum tubes nor transistor cir-cuitry. Equipment is reported priced for a wide market, with installation low in cost. No. 1245

A self-contained temperature stabilizer, quart size and factory sealed, has been designed to maintain a specified temperature within insu-lated shipping packages of up to 800 cu. in. It is reusable on recharge by purchaser. No. 1246

A 24-page brochure on lanolin reviews industrial origins of this wax, its composition, properties, U.S.P. grades, its cosmetic and pharmaceutical uses as emollient and emulsifier. Guide formulations are included.

No. 1247

A selective flocculant for ore refiners is said to precipitate dissimilar particles suspended in aqueous mixtures when only 0.002% based on weight is added to the ore suspension as a cold water slurry.

A new book on public relations for the diametric industry is being marketed. It discusses the atom as news, what the public wants to know about it, sources of information and techniques for approaching the public.

No. 1249 new book on public relations for the atomic

PRODUCTS OF U. 5 . 1

METALS

Titanium Sponge Zirconium Sponge and Platelets Hafnium Sponge and Oxido

OTHER PRODUCTS

Inorganic Chemicals: Sodium, Chlorine, Caustic Sodo, Sadium Peroxide, Sodium Sulfate, Sulfuric Acid, Phosphatic Fertilizer Solution (Wet Prac-ess Phosphoric Acid) Ammonia, Nitrogen Fertilizer Solutions, Ammon-lum Nitrose.

Alcohols: Ethyl (pure and all denatured formulas), Normal Butyl Amyl, Fusel Oil; Proprietary Denatured Alcohol Solvents SOLOX®, FILMEX®, ANSOL® M, ANSOL® PR.

PETROTHENE® Polyethylene Resins

Esters, Ethers and Ketanas: Normal Butyl Acetate, Dibutyl Phthalate, Diethyl Carbonate, Diethyl Oxaiate, Ethyl Acetate, Ethyl Ether, Acetane, Diato

Intermediates and Fine Chemicals: Acetoacetarylides, Dimethyl Hydrazine,
Ethyl Acetoacetale, Ethyl Benzoylacetale, Ethyl Chloroformate, Ethylene,
Ethyl Chloride, Ethyl Sodium Oxalacetale, U.S.I. ISOSEBACIC® Acid,
Methyl Hydrazine, Sodium Ethylate Solution, Triethyl Aluminum, Trimethyl Aluminum, Urethan USP (Ethyl Carbamale).

Animal Feed Products: Calcium Pantothenate, Choline Chloride Products,
Curbay 8-G® 80, Special Liquid Curbay®, DL-Methionine, Niacin USP,
Riboflavin Concentrates, Vilamin B₁₃ and Antibiotic Feed Supplements,
Vacatone® 40, Vitamin D₃ and Ky Products, Antifizationt (BHT) Products,
U.S.I. Permadry Products (Sealed-in Vitamin A), Special Mixes.

Pharmaceutical Products: DL-Methionine, N-Acetyl-DL-Methionine, Riboflavin USP, Urethan USP, Intermediates.

DUSTRIAL CHEMICALS CO.

Division of National Distillers and Chemical Corporation 99 Park Avenue, New York 16, N. Y.

U.S.I. SALES OFFICES

Atlanta . Baltimore . Boston . Buffaio . Chicago . Cincinnati Cleveland • Dallas • Detroit • Houston • Indianapolis • Kansas City, Mo. Los Angeles · Louisville · Minneapolis · Nashville · New Orleans New York . Philadelphia . Pittsburgh . Portland, Ore. . St. Louis Salt Lake City . San Francisco . Seattle



The temperature of this Wissco Rod Reinforced Belt varies from 2,050° F. to room temperature as it conveys steel fittings through a brazing furnace and into a water-cooled chamber.

WISSCO BELTS and the Mossberg Pressed Steel Corporation

The story of Wissco Belts is best told by their users. For instance, Mr. Robert B. Housman, design engineer for Mossberg Pressed Steel Corporation, Attleboro, Mass., reports:

"We obtained over a 100% increase in belt life—simply by switching to Wissco Belts."

And Mr. Housman goes still further: "What's more, the change to Wissco Belts enabled us to reduce belt maintenance costs by 15% and to spend 20% less time cutting slack out of our belts. We know of no other belt that can do a better job of withstanding the constant heating and cooling cycle of the brazing furnace and still maintain its inherent strength and consistency."

This Wissco Belt conveys steel fittings for braiding machines through the brazing furnace and into a watercooled chamber. Normal belt operation is for an 8hour, 5-day week; however, the furnace is put on a 16-hour day during peak months. This puts an additional strain on the metal belt since the 2,050°F, furnace temperature must be maintained around the clock under these conditions.

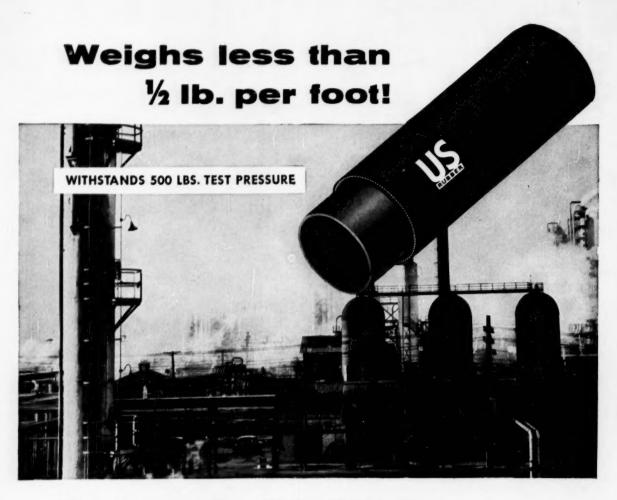
If yours is a high temperature operation . . . or any processing or conveying job . . . it'll pay you to get the complete Wissco Belt story. Contact our nearest sales office today.

THE COLORADO FUEL AND IRON CORPORATION—Derver and Oakland
WICKWIRE SPENCER STEEL DIVISION—Atlanta - Beston - Buffelo - Chicago - Detroit
New Orleans - New York - Philadelphia
CFEL OFFICES IN CANADA: Montreal - Teronto



WISSCO BELTS

PRODUCT OF WICKWIRE SPENCER STEEL DIVISION
THE COLORADO FUEL AND IRON CORPORATION



The super-flexible All-Dacron U.S. FLEXLITE® FIRE HOSE!

Its single jacket is all Dacron*—to give the lighter weight, pressure resistance, flexibility, rackability required by today's petro-chemical fire departments.

Although U.S. Flexlite weighs 50% less than conventional hose, it will handle extreme pressures! Its Neoprene tube and Dacron jacket have the required resistance to chemicals, petroleum, mildew, dampness, heat. Coils easily, dries fast. United States Rubber Company also makes the following hose for the petro-chemical field.

- (1) "Reliance®" Double Jacket Dacron reinforced (weighs 50 lbs. per 100 ft.) (withstands 400 lbs. test pressure)
- (2) "Reliance" Double Jacket Dacron reinforced (weighs 54 lbs. per 100 ft.) (withstands 600 lbs. test pressure)
- (3) U. S. Matchless® Carbolized-most rugged hose in the market.

Obtainable at any of the 28 "U. S." District Offices, at selected distributors, or write us at Rockefeller Center, New York 20, N. Y. In Canada, Dominion Rubber Co., Ltd.

*Dul'ont's polyester fiber



Mechanical Goods Division

United States Rubber

There's MORE

from Allis-Chalmers MOTOR distributors

Complete Motor Line

multi-speed

wound-rotor

face mounted

open

dc series

squirrel-cage

vertical solid

totally enclosed

LIS-CHALMERS

... plus quality

As part of a national network of more than 200 franchised outlets, your nearby Allis-Chalmers Motor Distributor offers the rare combination of fast service and a complete line of fine-performance integral horsepower motors. He's the right man to give you just the right motor — in a hurry.

It adds up to:

- 1. Simplified Buying Here's one source for all motors from 1 to 200 hp, as close as your telephone. Single source trims clerical costs, minimizes purchasing and accounting expenditures.
- **2.** Reduced Inventory You don't have to tie up funds and warehouse space with spare motors and replacement parts. The A-C Distributor is your motor storehouse.
- **3.** Continuous Production Your A-C Distributor can deliver a motor to your shop in a matter of hours. (And, once you order an A-C motor, you're sure of 'round-the-calendar operation.)

GET ACQUAINTED with your Allis-Chalmers Motor Distributor soon. You can find out his name by contacting the A-C sales office in your area, or write Allis-Chalmers, General Products Division, Milwaukee 1, Wisconsin. synchronous

vertical hollow shaft

drip-proof

foot

splash-proof

"Synduction"

explosion-proof

dc compound wound

flange mounted

dc shunt wound

gear motors

(AC)

duction is an Allia Chalmars trad

Another Graver Contribution to American Industry 1857-1957

IN 1884...73 YEARS AGO ...

They Scoffed at Wm. Graver's

Determination to Build

Storage Tanks with Light Plate



Quoted from an article "Graver Tanks Are Monuments to Confidence, Energy and Skill," The Southwestern Oil Journal, December 5, 1919:

C
• • • It had been the theory of Chicago tank builders that tanks should be constructed like boilers—made of heavy material and capable of standing a great pressure. Mr. Graver could erect his tanks much cheaper than those being put up by the Chicago concerns, but he was unable to get his just share of the business. He took contracts for other kind of work and his perseverance was finally rewarded by a contract to build four linseed tanks of considerable size for a Chicago concern. Failure was predicted by his competitors and Joseph T. Ryerson, from whom he was purchasing the material, also became skeptical of the outcome.

Having called Mr. Graver into conference and being assured that he had successfully constructed the lighter tanks for the Standard Oil Company, Mr. Ryerson gave the oil company his word that the tanks would fill all requirements and Mr. Graver was allowed to go on with the contract. William Graver, his son, J. P. Graver, now president of the company and Mike Sheets, the construction foreman, got the material out for the tank at their plant in Clark street.

The tank trade was especially interested in the construction of the tanks and they gathered daily to watch the erection. Gloomy predictions were voiced from the laying of the bottoms to the completion of the tanks. However, William Graver had his day when the first tank was tested out. A large crowd was on hand to see the tank filled up, and as the gauge on the tank soared and it still held, many of his competitors turned on their heels, wiser apparently in tank construction.

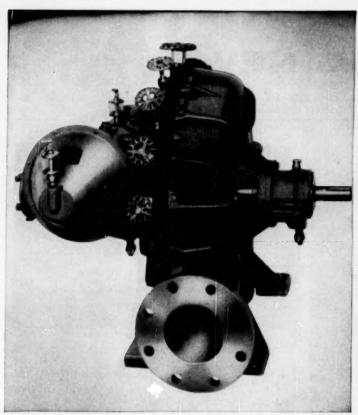
It was upon the completion of this tank that William Graver began to reap the fruit of his labor. Orders came pouring in and from that day to this the Gravers have been favored with a large share of the tank business. 9 9



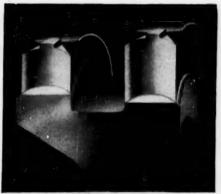


Building for the Future on a Century of Craftsmanship in Steels and Alloys GRAVER TANK & MFG. CO. INC.

EAST CHICAGO, INDIANA • NEW YORK • PHILADELPHIA • EDGE MOOR, DELAWARE PITTSBURGH • DETROIT • CHICAGO • TULSA • SAND SPRINGS, OKLAHOMA HOUSTON • LOS ANGELES • FONTANA, CALIFORNIA • SAN FRANCISCO



This is the reliable Coppus Turbine furnished with either type of wheel



Wide bucket "L" type wheel



Regular type wheel

Top performance in all COPPUS TURBINES

Both the regular type wheel or wide bucket "L" type wheel give you Coppus proven high quality and low maintenance cost. The "L" type wheel is the new development for use where low water rate is essential.

Coppus "Blue Ribbon Turbines" earned their fine reputation right on the job. Users vouch for their top quality performance and their low maintenance cost.

In the words of the supervisor of a large chemical company: "Coppus turbines require so little maintenance that a person would starve to death, if he depended on it for a living."

Proven features of all Coppus Turbines:

- Turbines rated close to your hp requirements, from 150 hp down to fractional. No need to buy a bigger, costlier turbine than your conditions call for.
- A larger number of steam nozzles, controlled individually by manually operated valves.
- Exclusive pilot operated excess speed

safety trip supplementing constant speed governor.

- Replaceable cartridge type bearing housings.
- Optional carbon ring packing glands.
 Coppus Steam Turbines ranging from 150 hp down to fractional, in 6 frame sizes, make turbine dollars go farther.
 Send for Bulletin 135 on Coppus Turbines.

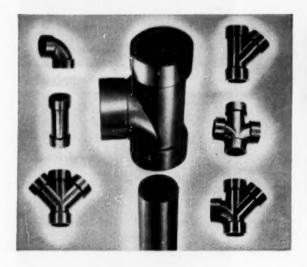
COPPUS ENGINEERING CORPORATION 227 Park Avenue, Worcester 2, Mass. Sales offices in THOMAS' REGISTER



PVC PIPING NEWS



PUBLISHED BY TUBE TURNS PLASTICS, INC. . LOUISVILLE 1, KENTUCKY



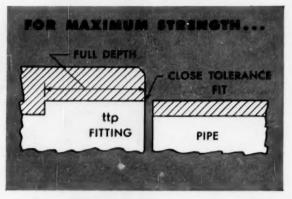
New drainage fittings offer big savings

Tube Turns Plastics announces a new line of PVC drainage fittings for carrying away corrosive waste liquids. Compared to cast alloys normally used, they cut labor and materials costs drastically. Can make solvent-cemented joints in about $\frac{1}{4}$ usual time. Available in all standard types . . . sizes $\frac{1}{2}$ " through $\frac{4}{2}$ ".

Extensive tests prove superiority of ttp solvent-cemented joints

Tube Turns Plastics has completed thousands of tests to show how maximum strength and joint-cementing speed are assured with **ttp** socket type fittings and solvent cement. Findings:

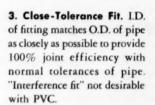
1. Full-Depth Socket. Strength of any PVC solvent-cemented joint depends on area of contact. Tube Turns Plastics was the first company to offer a complete line of socket-cemented PVC fittings having full depth of sockets providing areas of contact such that the joints are stronger than the fittings or pipe of same rating, when easily

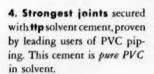


learned cementing technique is properly employed.

2. Socket bore tolerances are designed to avoid "interference fit" with pipe as normally made, yet provide more than

adequate joint strength. Slowing down of joint making is thus minimized and overstressing fitting is avoided.









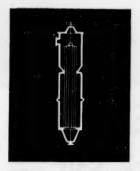
The full line...nearby

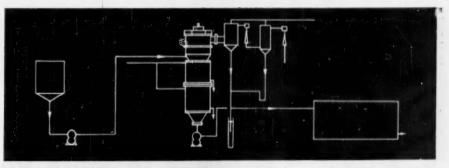
Your Tube Turns Plastics' Distributor can deliver promptly from the complete line of **ttp** injection molded fittings, flanges and valves... in sizes ½" through 4"... threaded and socket type... normal and high impact PVC... as well as solvent cement and thread lubricant. This one source can meet all of your requirements. Write for Bulletin TTP 119.

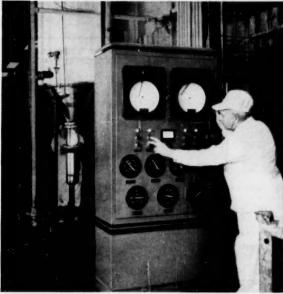
Leading Manufacturer of Injection Molded Polyvinyl Chloride Pipe Fittings, Flanges and Valves

TUBE TURNS PLASTICS, INC.

Dept. TTP-6, 2929 Magazine St. • Louisville 11, Kentucky









Concentration without degradation

Extreme care is required during the concentration of gelatin because of its sensitivity to heat, tendency to foam, and the resulting substantial increase in viscosity. At the Detroit plant of The American Agricultural Chemical Company a Turba-Film® Processor is extracting 1200 lbs. of water per hour from 2500 lbs. of gelatin solution with no "burn-on" or other degradation of the product. The process variables—feed rate, heat, input and operating pressure—are closely controlled from a central point during the continuous, single-pass operation.

Such Turba-Film features as the mechanicallyaided, turbulent, thin, falling film; minimum of hydrostatic head, and extremely short residence time, permit high concentration of a wide variety of heat-sensitive materials with no "burn-on". The Turba-Film Processor is performing equally well in many applications of heat and mass transfer operations involving vapor-liquid equilibria such as deaeration, absorption, distillation, deodorization, countercurrent stripping, demonomerization of polymers, and deammoniation of natural latex.

We offer completely engineered package systems for the chemical, pharmaceutical and allied industries. Qualified engineers are available to discuss the application of the Turba-Film Processor in solving your processing problems.

RODNEY HUNT MACHINE CO.

Process Equipment Division

31 Vale Street, Orange, Massachusetts, U. S. A.



SERVING THE CHEMICAL AND PROCESSING INDUSTRIES WITH EQUIPMENT AND ENGINEERING

Using Salt Efficiently

by INTERNATIONAL SALT COMPANY, INC.-America's largest producer of salt



"Wet Storage"—an Economical Way to Store Rock Salt

A problem frequently encountered by sult-using companies is how to make the best use of available tank space for rock-salt storage. There are three basic ways to store salt in tanks: in brine form, in dry form, and in "wetted" form (dry salt stored under covering brine). Each method has certain advantages.

Salt stored in the form of fully saturated brine offers the important advantage of convenience: the brine can be pumped to points of use in the plant, eliminating salt-handling expense. However, the amount of salt which can be stored in this way is relatively small, because each cubic foot of brine contains only about 19¾ lbs. of salt in dissolved form.

Salt stored in dry form makes far better use of available tank space: each cubic foot contains an average of 72 lbs, of rock salt—about 3.6 times the amount which can be stored as brine. However, moving dry salt to points of use is time-consuming, inconvenient, and expensive. And dry-salt measurement is not as exact, or as easy, as measurement of fully saturated brine.

To get the benefits of fully saturated



brine, along with the space-saving storage of drysalt, many saltusing companies are now using the tankstorage method known as "Wet

Storage." This method—which actually combines features of dry storage and brine storage—offers these advantages:

- Any given tank can store more salt than is possible when either dry salt or saturated brine is stored by itself.
- There is a constantly available supply of fully saturated brine for every plant need.
- Much less handling of rock salt is required. There are fewer salt deliveries, fewer brine-making problems.

How "Wet Storage" works. When a tank is filled with dry rock salt, almost half the storage space is actually "empty," because the salt crystals do not pack solidly together. But when the voids between the crystals are occupied by fully saturated brine, additional amounts of salt can be stored. This is because fully saturated brine itself contains 2.65 lbs. of salt per gallon. Thus, with salt stored both "wet"

COMPARISON OF DRY
THREE STORAGE
METHODS FOR SALT

BRINE

BRINE

32
TONS

HERE'S PROOF OF "WET-STORAGE" EFFICIENCY. Columns show amount of salt which can be stored in a tank 20' deep and 20' in diameter—by the three different methods. "Wet Storage" is obviously the best method, makes full use of available space.

and in brine form in the same tank, maximum space is used for salt storage.

For example: in a circular tank 20 ft. in diameter, and 20 ft. in storage depth, the following amounts of salt can be stored, using the system of wet storage:

In "wetted" form the tank will hold about 231 tons of rock salt. In addition, there will be about 28 tons of salt dissolved in the covering brine. Total salt contents of the tank: 259 tons. Compare this with the other two salt-storage methods: The same tank will hold only 62 tons of salt dissolved in brine and about 225 tons in dry form.

Lixator best example of "Wet Storage"



principle. Storing salt under covering brine is the basic operating principle of International's exclusive Lixate Brine-Making Proc-

ess. In the Lixator, dry rock salt and fully saturated brine are combined, making fullest use of available storage space—and, at the same time, providing pure, crystalclear brine for immediate use when and where it's needed.

In the Lixator (which is filled with rock salt), water is admitted at the top. This water dissolves some of the rock salt, to make fully saturated brine. This brine then fills the voids between the remaining salt crystals. As brine is drawn off, it is completely filtered by the salt crystals in the bottom portion of the Lixator. More rock salt is then automatically fed into the

Lixator from the storage supply, and more brine is made to occupy the empty spaces.

Today, International offers many types of Lixators—all based on the principle of "WetStorage." There are Storage Lixators, Silo Lixators, Sterling Model Lixators—in numerous designs to suit any plant layout.



TECHNICAL SERVICE WITH YOUR SALT

Through skilled and experienced "Salt Specialists," International can help you get greater efficiency and economy from the salt you use. International produces both Sterling Evaporated and Sterling Rock Salt in all types and sizes. And we also make automatic dissolvers in metal or plastic for both kinds of salt. So we can recommend the type and size of salt most perfectly suited to your needs.

If you'd like the assistance of an International "Sait Specialist" on any problem concerning salt or brine—or further information on "Wet Storage"—just contact your nearest International sales office.

International Salt Co., Scranton, Pa.

Sales Offices: Atlanta, Ga.; Chicago, Ill.; New Orleans, La.; Baltimore, Md.; Boston, Mass.; Detroit, Mich.; St. Louis, Mo.; Newark, N. J.; Buffalo, N. Y.; New York, N. Y.; Cincinnati, O.; Cleveland, O.; Philadelphia, Pa.; Pittsburgh, Pa.; and Richmond, Va.

FOR INDUSTRY, FARM, AND THE HOME-

PRODUCT OF INTERNATIONAL SALT CO. INC.

Why DYNALOG*design is out front of all electronic potentiometers . . .

IT'S THE MAINTENANCE MAN'S DREAM!

Advance features to improve control of temperature, pressure, flow . . .

- 1. No periodic maintenance
- 2. No dry cell-no standardizing
- 3. No high-speed moving parts
- 4. No slidewire or galvanometer
- 5. Stepless, continuous balancing
 - 6. Adaptable to narrow spans

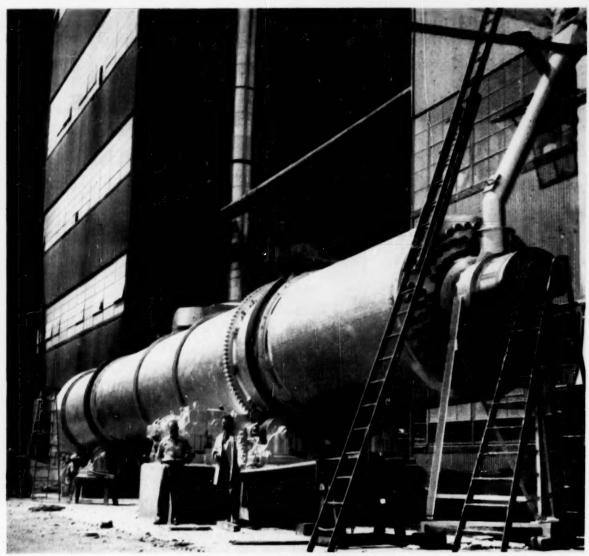




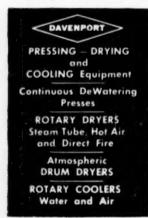
Yes, you can actually eliminate the continual inspection and maintenance usually required by balancing-type process control instruments! DYNALOG Electronic Instruments provide uninterrupted evaluation of many process variables . . , sustained high accuracy. DYNALOGS are inherently free from "drift" or mechanical problems . . . have no dry cells to standardize or replace . . . require no lubrication or alignment. They're dustproof, vibration-proof, foolproof.

This troublefree performance is a direct result of the unique DYNALOG Design. No troublesome slidewire and balancing motor . . . just a simple, variable radio-type capacitor and positive magnetic drive. The friction-free system responds instantly . . . gives unmatched smoothness of balancing . . . years of faultless service. DYNALOG Instruments are used with any primary element - resistance, voltage, capacity, inductive - wherever there's a precise control or recording job to be done. For the complete story, write for Bulletin 20-10. The Foxboro Company, 367 Neponset Ave., Foxboro, Mass., U.S.A.

*Reg. U. S. Pat. Off.



THE FIRST OF TWO "DAVENPORT" STEAM TUBE DRYERS for Drying and Conditioning SOYBEAN MEAL in a large Illinois grain plant



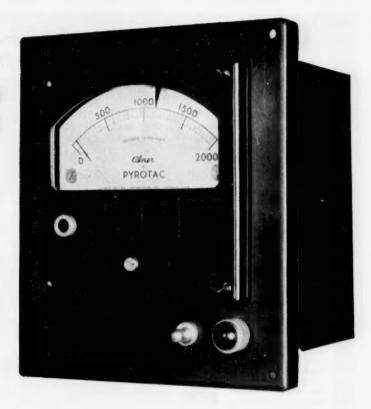
The above Steam Tube Dryer is an 8'-0" diameter x 70'-0" long, and will dry soybean meal from a solvent extraction process at the rate of 2,000,000 lbs. per day.

Let our engineers consult with you on your Pressing, Drying, and Cooling problems. Send for complete Catalog A, or for quick reference, consult your Chemical Engineering Catalog.



PYROTAC





Automatic protection against temperature damage

Just as a fuse protects electrical circuits against overloads, the Alnor Pyrotac automatically protects furnaces, kilns and other heating equipment against damage due to excessive temperatures.

This low-cost, easily installed instrument can be added to any automatic or manually controlled equipment and give continuous protection...safeguard your investment in equipment, controls and material in process.

Highest Alnor quality throughout, the Pyrotac features Alnico magnet, double air-gap movement that is standard in all Alnor pyrometers...laboratory precision...industrial ruggedness which assures top reliability.

Write today for complete details on the Pyrotac, available in eight scale ranges from 0-600° F. and 0-3000° F. Ask for Bulletin 2002. Illinois Testing Laboratories, Inc., Room 559, 420 North LaSalle St., Chicago 10, Illinois.



ALNOR PRECISION INSTRUMENTS FOR EVERY INDUSTRY

IS YOUR INDUSTRY LISTED HERE?

Abrasives Aeronautical **Automotive Brick and Tile** Ceramic Cement and Concrete Disinfectants **Electrical Manufacturing** Electroplating Engraving and Electrotyping Feed Stuff, Mineral Feed Fertilizer Insecticide and Fungicide Laundry Leather Lithographing Linoleum and Floor Covering Lubricant Match Metallurgical Metal Working Oil Cloth Optical Paint, Varnish and Lacquer Paper Petroleum **Pharmaceutical** Photographic Porcelain Enamel **Plastics** Pottery Printing Ink Pyrotechnic Refractories Rubber

FREE! This 16-page booklet lists the many chemicals available from Harshaw.

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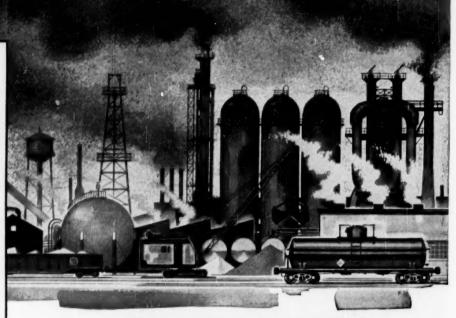
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Soaps



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Electroplating Salts, Anodes and Processes

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ECONOMICAL FROM EVERY ANGLE

'AMERICAN' Every THERMOMETERS

No longer is it necessary to fuss and figure what angles of stem connection are required in thermometers for each location. These American "Every Angle" Dial Thermometers can be set at any angle within 180° on two axes—set at the best angle for easiest reading.

Regardless of what piping arrangements are engineered into your processes — no matter how many times they are revised — the list of American "Every Angle" Thermometers in your original specifications need not be changed. Equally important, your thermometer inventory in all required temperature ranges and stem lengths will be far smaller. That's real economy — from every angle.

Bi-metal . . . mercury , . . vapor pressure – all three types of actuation are available in American "Every Angle" Dial Thermometers. They are precision instruments that assure accuracy within 1% of scale range. Their high accuracy is sustained throughout service life, whether installed indoors or outdoors.

Make full use of these highly sensitive thermometers at all important check points in your plant. You will maintain product quality far better than ever before. Your field operators will be able to take readings more easily, more accurately, more frequently—will save time-stealing trips to the control house. Convince yourself of the all-around economy of American "Every Angle" Dial Thermometers. Write for complete information.



BI-METAL ACTUATED, TYPE 6060AH. 5" Anti-Parallax Maxivision Dial, Temperature Ranges: —80/120 F. to +200/1000° F. Stem Lengths: 4" to 24". Climate-proof stainless steel case.

MERCURY ACTUATED, TYPE 6042RM. 4½" Anti-Parallax Maxivision Dial. Temperature Ranges: —20/120° F. to 200/ 1000° F. Stem Lengths: 4" to 24". Climate-proof glass and stainless steel case.

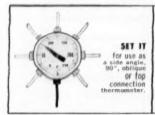




vapor pressure actuated, type 6040TW. 3½" Dial. Temperature Ranges:—20/120° F. to 260/450° F. Stem Lengths: 3" to 24". Models for indoor or outdoor service.

Separable sockets can be supplied in all materials and sizes normally required.

SET-ABILITY THAT MEANS FLEXIBILITY IN APPLICATION





set et for use as a straight-form thermometer.



SET IT for use as an obliqueform thermometer.



SET IT for use as a standard 90° back-connected thermometer.



CALL ON YOUR INDUSTRIAL SUPPLY DISTRIBUTOR for experienced counsel in dial thermometer selection. You can depend on him for prompt delivery from local stocks.

In Canada: Manning, Maxwell & Moore of Canada, Ltd., Galt, Ontario

AMERICAN INDUSTRIAL INSTRUMENTS



A product of MANNING, MAXWELL & MOORE, INC. STRATFORD, CONN.

MAKERS OF 'AMERICAN' INDUSTRIAL INSTRUMENTS, 'ASHCROFT' GAUGES, 'CONSOLIDATED' SAFETY VALVES, 'AMERICAN-MICROSEN' INDUSTRIAL ELECTRONIC INSTRUMENTS, Stratford, Conn. 'MANCOCK' VALVES, Watertown, Moss, 'CONSOLIDATED' SAFETY RELIEF VALVES, Tulsa, Okia. AIRCRAFT CONTROL PRODUCTS, Danbury, Conn., and Inglewood, Calif. "SHAW-BOX" AND 'LOAD LIFTER' CRANES, 'BUDGIT' AND 'LOAD LIFTER' HOISTS AND OTHER LIFTING SPECIALTIES, Muskegon, Mich.

STAINLESS STEEL TYPE G.I.

CORROSION-RESISTANT

handling materials and hot gases in chemical and process industri

- 9 Type 304, 316 or 347 Stainless
- . Heavy Construction
- Reversible and Retatable

Corrosion of air handling equipment in chemical and process industries is all too frequent. The nyb Stainless Steel General Industrial Fan resists injurious fames while operating at top efficiency at temperatures up to 800°F. Other protective surfaces available for mild, low temperature conditions include paints, coatings such as reains and phenolics, and complete vulcanized rubber lining that cannot bubble, peel or tear away.



ANNOUNCING

THE 1957 GLYCERINE RESEARCH **AWARDS**

FIRST AWARD \$1,000

SECOND AWARD 300

THIRD AWARD 200

These annual awards were established in 1952 to recognize research leading to new and improved applications of glycerine and glycerine derivatives. Award winning work may deal with the chemical, physical or physiological properties of these materials; with actual or projected uses; or with scientific principles likely to stimulate future applications. Originality in extending the usefulness of glycerine into new fields will receive special consideration.

BASIS OF ENTRY

These awards are open to any individual in the United States or Canada engaged in research, either in industry or with government or educational institutions. Entries by research teams of two or three associates are eligible. Persons connected with member companies of the Glycerine Division, Association of American Soap & Glycerine Producers, Inc., or laboratories

which they employ are not eligible.

First consideration will be given to work which has come to a clear-cut point of accomplishment during the current year; but work carried on in previous years, the significance of which has been confirmed by commercial application in 1957, also will be eligible.

Entries will be judged by a committee of three persons of outstanding reputation and scientific background, having no connection with the Association or its members.

METHOD OF NOMINATION

Nominations must be made on the official entry blank, which may be obtained by writing to: Awards Committee, Glycerine Producers' Association, 295 Madison Avenue, New York 17, N. Y.

All nominations for the 1957 awards must be received by November 1, 1957 to be eligible.

Honor Role of Glycerine Research Award Winners

1952

Dr. Ivan W. Brown, Jr.
Duke University School of Medicine and
Rev. Basile J. Luyet
Institute of Biophysics, St. Louis University First

Second Dr. Raymond Reiser and Dr. Hermann Schlenk Texas Agricultural Experiment Station

Research team at Southern Regional Research Laboratory headed by Dr. Reuben O. Feuge

1953

Dr. Erich Baer University of Toronto First

Second Dr. Lewis I. Gidez Brookhaven National Laboratory and Dr. Manfred L. Karnovsky Harvard Medical School

Albert C. Nuessle Rohm & Haas and Russell F. Crawford, Jr. Sharon Hill, Pa.

1954

Prof. Robert K. Summerbell Northwestern University and Dr. James R. Stephens American Cyanamid Co. First

Second Two research teams:
Dr. Robert W. Swick and Akira Kakao
of Argonne National Laboratory and
Dr. Harland G. Wood and Dr. Per Schambye
of Western Reserve University

Dr. Henry A. Sloviter University of Pennsylvania Third

1955 First Dr. Reed A. Gray Merck & Co.

Dr. Eugene P. Kennedy University of Chicago

Dr. Karl H. Lauer University of Alabama

Dr. Herbert J. Dutton U. S. Dept. of Agriculture

1956

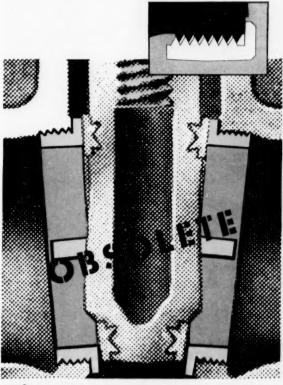
Second Dr. Donald Zilversmit University of Tennessee Dr. Stanley G. Knight University of Wisconsi

ARE <u>YOUR</u> TRIM SPECS UP TO DATE?

Put an end to iron valve seat ring and stem-wedge problems. Make sure your specifications call for modern, trouble-free OIC endseated seat rings and T-head stems.

There is no extra cost and yet this superior design will reduce your maintenance overhead many times.

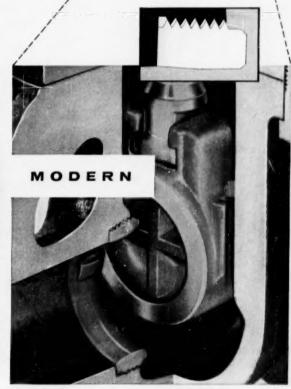
For specification details write for OIC Iron Valve Bulletin No. 1005. The Ohio Injector Co., Wadsworth, Ohio.



Shoulder-seated rings Screwed stem-wedge connection

Ring design causes turbulence. Open back of ring is easily eroded. Ring is seated in tension. Continuous operation compresses and tends to loosen it, developing serious leaks.

A screwed stem-wedge connection is rigid. Closing valve under pressure tends to bind wedge, make closing difficult and perhaps bend the stem.



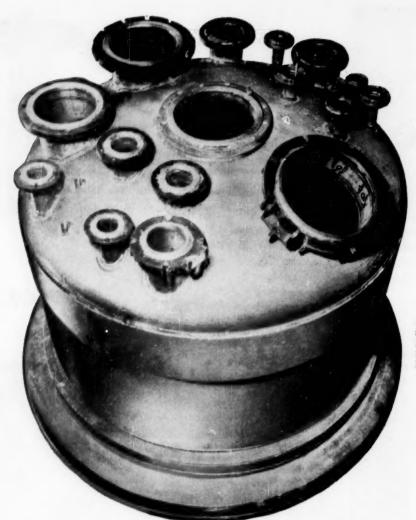
OIC end-seated rings T-head, stem-wedge connection

Streamlined flow-through. No pockets open to attack by erosion. Ring is seated in compression. Stays tight even in continuous operation.

T-head stem-wedge connection is flexible. Wedge can't bind. Clasing is easy and stem is unaffected.



FORGED & CAST STEEL, LUBRICATED PLUG, BRONZE & IRON VALVES



Alkyd resin kettle fabricated by Process Engineering & Machine Co., Inc., Elizabeth, N. J.

Lukens clad steel cuts kettle cost

Purity—with economy—assured in alkyd resin vessel

Utmost purity of alkyd resins to give highest gloss and reflectivity to paints. That's just one advantage gained by fabricating this Dowtherm-heated alkyd resin kettle from Lukens 316 stainless-clad steel. Of equal importance is the first-cost economy this material offers.

John Lucas & Co. of Gibbsboro, N. J. achieved faster heat transfer with stainless-clad, and hence greater process efficiency, because of this material's carbon steel backing. The clad steel cost them less than solid high alloy. And, despite the kettle's many fittings and two jackets, fabrication presented no great difficulty.

Lukens clad steels, from 3/16" gage up, have achieved new economies and efficiency throughout

the chemical industry. Only Lukens makes available a choice of 16 cladding and 11 backing metals to meet virtually any tank or pressure vessel need. Consult your equipment builders or write for new technical booklet, "Clad Steel Equipment." Address Manager, Marketing Service, Room 970, Lukens

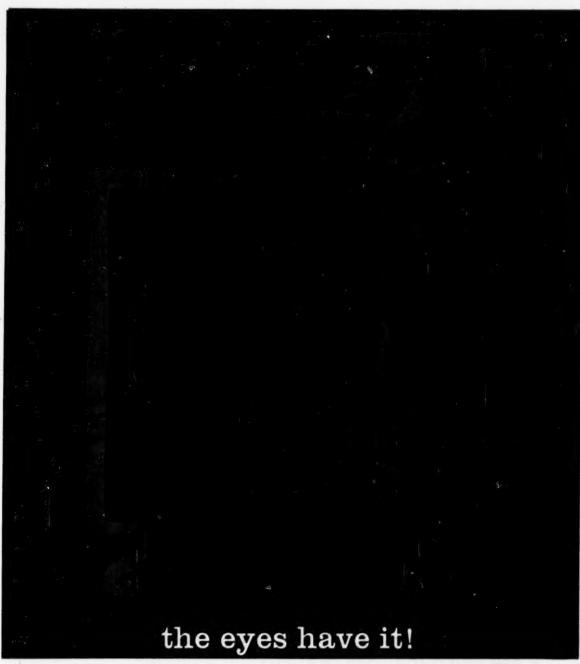
Steel Company, Coatesville, Pennsylvania.

This is Lukens clad steel — not a lining, not a soldered-on surface, but a solid

steel plate—one side corrosion resistant metal permanently bonded over-all to rugged, economical backing steel.



Helping industry choose steels that fit the job



SOLVESSO XYLOL, like all Esso Petroleum Solvents, is unsurpassed for uniformity and purity. The hallmark of quality in the entire resin industry, it assures top performance from modern, high resistance surface coatings of all kinds. You can count on the family of Esso aromatic solvents for more-than-standard performance. And their distribution through a highly developed supply system geared for peak efficiency and utilizing modern, proven handling methods, assures industry that these key materials are always immediately available for prompt delivery. For the "Finish that Wins the EYES and 'AYES'," start with Esso Petroleum Solvents. Write or phone today! Esso Standard Oil Company, Inc., 15 West 51st Street, New York 19, N. Y.

SOLVESSO TOLUOL . SOLVESSO XYLOL . SOLVESSO 100 . SOLVESSO 150 PETROLEUM SOLVENTS A FAMILY OF FOUR AROMATICS FOR ALL OF INDUSTRY'S REQUIREMENTS!



Here's why leaders in American Industry are using the L&N Stabilized Indicator

Quick Warm-Up-less than 60 seconds.

Fast Response—about 1.5 seconds.

Measuring Errors "Designed Out"—completely unaffected by zero drift, electrical pickup, a-c surges.

Only Two Adjustments—standardization and temperature compensation.

Fine Performance—limit of error, ± 0.1 pH; reproducibility, ± 0.02 pH.

Low Price—\$275.75 for 120 v. model; \$300.75 for 240 v. model, f.o.b. Phila. (subject to change without notice). Supplied with glass and reference electrodes, buffer, and potassium chloride solution.

Use No. 7664-A1 (120 v.) or 7666-A1 (240 v.) when ordering, or write Leeds & Northrup Co., 4916 Stenton Ave., Phila. 44, for details in Data Sheet E-96(2).



Sam Spinner's Mail Box



by Sam Spinner

Case #1: A Gelatinous substance from an adhesive in waste water was causing objectionable odors in a waste pond. The method of controlling these odors by spraying was costly, time consuming and offered only temporary relief.

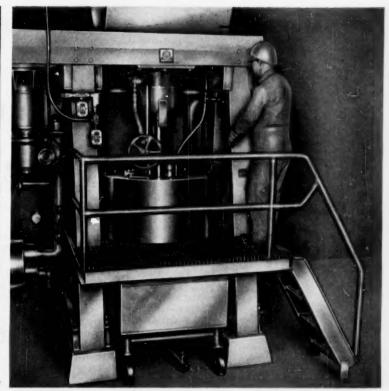
Solution: An AT&M Imperforate Basket separated the Gelatin from the wash water, concentrating it so that the machine required cleaning out only once every 8 hours by the AT&M Unloading Drive and Plow.

Case #2: A bulky product, that required careful handling, had to be packed in bags before placing in an extractor to spin off the excess moisture. The bags were then lifted out of the machine after the extraction and emptied. A slow, expensive and back breaking operation.

Solution: AT&M designed a machine that handled the product without the use of bags, weighing each load before gently loading the basket at 20 rpm through AT&M's Slow Speed Loading Drive. After extraction, the basket was unloaded on to a conveyor by AT&M's latest type bottom discharge basket that does not require a plow. The above cycle was automatically timed throughout, eliminated the need of an operator, and handled the product more gently than by the previous method.

Case #3: Clarification of a liquid required high speed and production demands necessitated a fast rate of feed. These two factors combined to give an additional problem of foaming.

Solution: AT&M built a high speed machine with an extra deep basket that provided a longer retaining time and gave the clarification required at the fast rate of feed. The addition of a fume tight cover and special venting of the outlet pipe overcame the problem of excessive foaming.



AT&M specially engineered this suspended centrifugal for use in the purification of sodium borohydride at the Metal Hydrides, Inc. plant in Beverly, Massachusetts.

How Metal Hydrides, Inc. solves a centrifugal problem

The AT&M centrifugal shown above is AT&M's Model V 32. Its basket capacity is four cubic feet. It is easily loaded from the top and features explosion-proof motors.

If you have a separating problem, AT&M can set up a mobile laboratory in your plant to determine on the spot whether an AT&M centrifugal can solve it.

Safe, space-saving AT&M centrifugals are widely used in Separation, Dehydration, Coating, Filtering, Impregnation and Sedimentation processes. Send coupon for full data.

AMERICAN TOOL & MACHIN 1415 Hyde Park Ave., Boston 36,	
Please send me my free copy of the Force." I am interested in the follow	
Separation Extraction Coating Filtration Draining Sedimentation	
SAVE TIME, SPACE	
AND COSTS WITH	NameTitleTitle
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EFFECTIVELY CONTROLLED BY "BUFFALO" EQUIPMENT

No matter how complex your air cleaning problem may seem, chances are very good that some "Buffalo" unit can clear up the situation to your complete satisfaction.

Take the "Buffalo" Hydraulic Scrubbing Tower. It cleans by centrifugal spray action, plus scrubbing action against a wetted surface — provides high collection efficiency — resists heat, corrosion and abrasion — has no tendency to clog. It's controlling everything from coke breeze to stringy, linty discharges. Maintenance is simple and operating costs, low.

Or, for acid mists, fumes and vapors, the "Buffalo" Absorption Type Washer may be the best solution for your particular problem.

And so on. The "Buffalo" line of equipment is complete, resulting from a half-century of experience in "taming" some of the toughest industrial effluents, from pilot plant to production. Write or phone the Buffalo Engineering Representative in your territory, to take advantage of this experience and the "Q" Factor* in "Buffalo" Equipment for the results you want!



"Buffalo" Hydraulic Scrubbing Tower

"Buffalo" Absorption Type Washer



*The "Q" Factor — the built-in Quality which provides trouble-free satisfaction and long life.

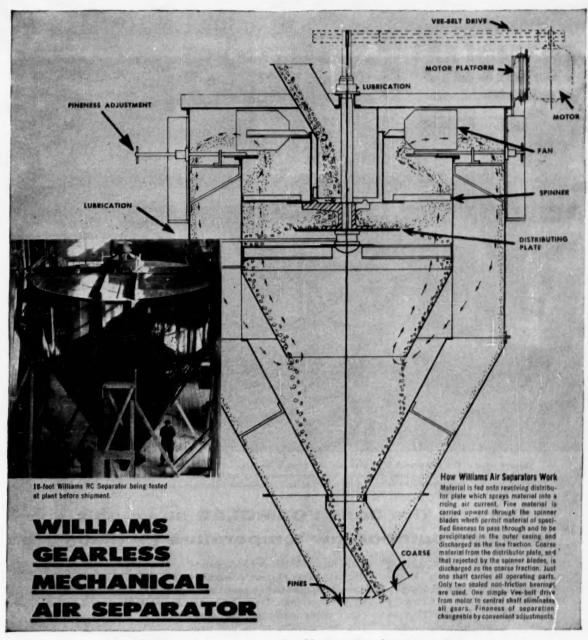


BUFFALO FORGE COMPANY

BUFFALO, N. Y.

Canadian Blower & Forge Co., Ltd., Kitchener, Ont.

VENTILATING AIR CLEANING AIR TEMPERING INDUCED DRAFT EXHAUSTING FORCED DRAFT COOLING HEATING PRESSURE BLOWING



20 To 325 Mesh Separations—Trouble-Free Gearless Operation

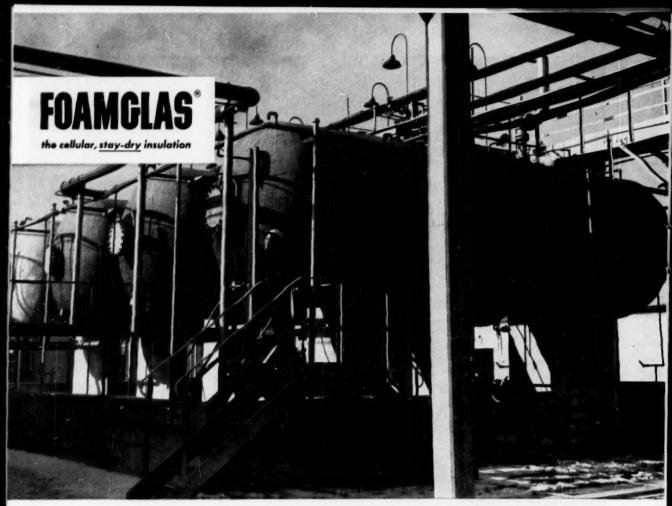
For removing fines from coarsely ground material or for making separations of fine material (the separations ranging from 20 to 325 mesh), Williams Mechancial Air Separators provide the lowest cost, maximum production equipment yet devised. Separation is by specific gravity and no fine delicate screens are employed. Output is unusually high even for fine separations. Construction is heavy duty throughout with heavy steel plate casing, simple gearless drive

and heavy internal construction. Only two antifriction bearings are used. They are enclosed in dust-proof and moisture-proof housings. All sizes permit adjustment for wide variation in fineness of separation. Let us send you complete information.

9 Standard sizes. Capacities, 1/4 ton to 75 tons hourly.

WILLIAMS PATENT CRUSHER & PULVERIZER CO. 2706 North 9th Street St. Louis 6, Mo.





These 4 General Tire tanks, each 9' in diameter and 27' long, operate year 'round at 50°F. and 35 psi to hold vinyl chloride monomer in a liquid state. Accurate, economical temperature-pressure control is easy because the tanks' jackets of 2" FOAMGLAS insure constant, high insulating efficiency. 1000 lin. ft. of supply and refrigeration lines are also protected by 2" FOAMGLAS.

General Tire finds FOAMGLAS stays efficient in tough, outdoor low temperature insulating job

Outdoor low temperature piping and equipment is one of industry's toughest insulating problems. That's why General Tire and Rubber Company picked tough, durable FOAMGLAS to insulate 4 outdoor vinyl chloride tanks, supply and refrigeration lines at their Ashtabula, Ohio plant.

General's past experience with FOAMGLAS at other plants had proved that its inorganic, all-glass composition and sealed cellular structure make it immune to moisture, acid atmospheres, spillage, condensation damage and the other hazards of insulating outdoor equipment. Its insulating value can't vary . . . ever! It's dimensionally stable and completely incombustible, too.

P. J. Wallace, Manager of the Ashtabula plant says: "Even when insulating conditions are toughest, we count on FOAMGLAS for constant efficiency to permit easy, economical control of pipe and equipment operating temperatures. It eliminates frequent, costly insulation replacement and the expensive production shutdowns that result."

What's your insulating problem? Tough or easy, you'll solve it best with FOAMGLAS. Prove its unique benefits to yourself! Send today for a free sample and directions for six easy tests to try in your own office. Ask for FOAMGLAS Industrial Insulation Booklet, too. Address...

Pittsburgh Corning Corporation

Dept. H-77, One Gateway Center Pittsburgh 22, Pennsylvania In Canada: 57 Bloor St. W., Toronto, Ontario Application of FOAMGLAS tank jackets was done quickly and at low cost because of the insulation's light weight, strength, rigidity and ease of cutting. FOAMGLAS was banded in place (stainless steel on 9" centers), joints were sealed and a covering spray-coat of fibrated asphalt cutback applied.



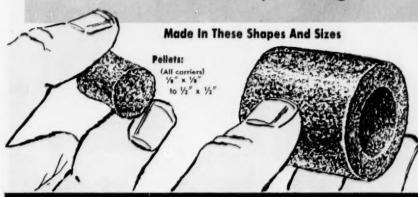


Also manufacturers of PC Glass Blocks

ALUNDUM* Catalyst Carriers

and Supports

are proved aids to better, lower cost processing



Spheresi

(Low surface area)

1/16" to 1 ½" diameter
(Intermediate surface area)

1/4" to ½" diameter

Rings:

(All carriers)
%" x 1/4" to 1/4" O.D.
to 1" x 1/2" x 1/2" O.D.

Norton Alundum catalyst carriers have excellent mechanical, thermal and chemical stability. They are crystalline in nature and are produced in two surface area types: Intermediate $(5-70\mathrm{m}^2/\mathrm{gram})$ and Low (less than $1\mathrm{m}^2/\mathrm{gram}$).

The alumina content of the intermediate carriers is approximately 77%. These are subdivided into Types A, B and C, with varying characteristics. In the low surface area carriers, the alumina content ranges from 77% to 92%.

PHYSICAL PROPERTIES

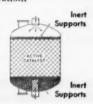
THISTORE PROPERTIES								
	Apparent Parasity	Water Absorption	Bulk Density	Vol. Bulk Density	Crystal Structure	Surface		
Intermediate Surface Area Type A	45-50%	28-30%	1.65-1.70 gr/cc	58 fbs/ft ³ (Approx.)	Quartz, Alpho, Gamma Alumins — chiefly Gamma Alumina	60-70m ³ /gram		
Туре В	45-50%	28-30%	1.65-1.70 gr/cc	60 lbs/fr ⁹ {Approx.}	Quarts, Alpha, Kappa, Delta Alumina	20-30m ⁹ /gram		
Type C	45-50%	28-30%	1.65-1.70 gr/cc	62 lbs/ft³ (Approx.)	Alpha Alumina and Mullite	5-10m²/gram		
Low Surface Area	10-50%	3-25%	1.90-3.15 gr/εε	65-80 lbs/ft ³	Alpha Alomina and	Less than 1m²/gram		

Some Of Many Applications

Suggested Applications For Intermediate Surface Carriers include catalytic reforming, dehydrogenation, dehydration, sulfuric acid manufacture, nitric acid manufacture and dessicants.

Low Surface Area Carriers are used in the processing of phthalic anhydride, maleic anhydride and ethylene oxide; also in protective atmospheres and synthetic gas generation.

Suspending Active Catalysts Effectively



In fixed bed convertors where it is necessary to suspend active catalysts at a given level, supports produced by Norton are used successfully. Made of dense, rugged, electrically fused materials these supports have great resistance to breakdown and have no chemically reactive effect on the processing.

Get More Facts

on how Norton catalyst carriers and supports can improve and economize your processing. On request, they can be prepared from other materials such as: CRYSTOLON* silicon carbide, MACNORITE* fused magnesia, zirconium oxide, silica, etc. Call in your Norton Refractories Engineer or write, mentioning your requirements, to Norton Company, Refractories Division, 506 New Bond St., Worcester 6, Massachusetts.

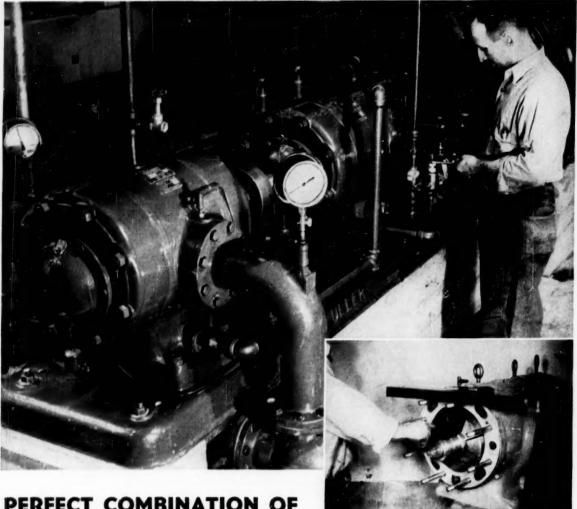


Engineered ... Prescribed

Making better products ... to make your products better

NORTON PRODUCTS:
Abrasives • Grinding Wheels
Grinding Machines • Refractories
BEHR-MANNING PRODUCTS:
Coated Abrasives • Sharpening Stone

*Trade-Marks Reg. U.S. Pat. Off. and Foreign Countries



PERFECT COMBINATION OF MEN AND MACHINES

Blade inspection

Providing plant air for varied uses imposes heavy responsibility on both the compressor and its operator to keep production moving.

The simplicity of the Fuller Rotary Compressor principle reduces maintenance to an absolute minimum; by the same token, operator's universal pride in Fuller Rotary performance contributes to longer life of the compressor. Few moving parts and smooth operation limit the operator's work to periodic inspection.

This perfect combination of men and machines is worth investigating, with an eye to economies you, too, can enjoy. Write to Fuller Company, compressor sales department for detailed information.



FULLER COMPANY 134 Bridge St., Catasaugua, Pa.

SUBSIDIARY OF GENERAL AMERICAN TRANSPORTATION CORPORATION

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C-316

PIONEERS OF HIGH-EFFICIENCY VANE TYPE ROTARY COMPRESSORS SINCE 1930

Some Things to Think About Steam Traps

...in order to get high operating efficiency and a minimum of maintenance

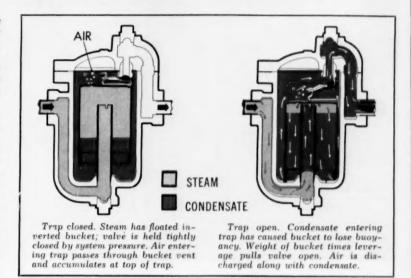
The gentleman who invented the wheel had a basic idea and so far no one has come up with anything better for the purpose.

If you'll pardon us for a little overemphasis on the significance of steam traps, we'd like to liken one of them to the wheel.

In 1911, when the first Armstrong inverted bucket steam trap model was announced to the world, or at least that part of the world that modest advertising and sales budgets would cover, it was not received with equal enthusiasm by all (especially old-style trap makers). But, like the wheel, it managed to find its way into general use. And, nothing better has ever turned up for the purpose of draining condensate. As a matter of fact, the Armstrong trap has been very widely copied. Today, there are more inverted bucket traps draining process equipment than any other kind. Of these, there are more Armstrongs.

If this sounds like the boasting of a proud parent, give consideration to some fundamental requirements not met by all traps:

- 1. A steam trap should not leak steam. Some traps do, you know, because of the nature of their operating principle. No steam ever gets to the Armstrong trap orifice. The valve is always water sealed.
- 2. A steam trap should vent "air" as fast as it accumulates—otherwise temperatures are reduced and corrosion is a problem. The Armstrong trap handles air very nicely. The vent in the bucket permits air to accumulate in the top of the trap, from where it is discharged when the trap opens. For extreme conditions like draining paper machine dryers, some jacketed kettles and certain other units, the vent is sized larger for the job. And, for handling big volumes of air during warm-up, a bucket with an auxiliary thermic vent really speeds up heating.
- 3. A steam trap should discharge condensate at steam temperature if you want to get



maximum efficiency from the unit drained. And most people certainly do. If you have to wait for the condensate to cool, it's almost impossible to maintain maximum temperatures and prevent air build-up. You guessed it—the Armstrong trap opens for water, without dependence on temperature.

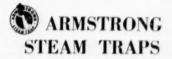
- 4. A steam trap should be suitable for any return system. The Armstrong trap works just the same whether discharging to atmosphere, back pressure or vacuum. It has been conclusively proved that flash steam resulting from use of a bucket trap does not cause a problem in vacuum return systems. The flash condenses rapidly. It's the leaky traps that cause the headaches.
- 5. A steam trap should not be a "prima donna". Some kinds of traps take an awful lot of care and coddling. The Armstrong trap is a rough and ready type with a hardened chrome steel constitution (valve and seat, to be exact). It cleans itself of ordinary dirt and scale without choking up. Its 18-8 stainless parts stave off rust and corrosion. It resists wire-drawing and wear remarkably well. In fact,

it stays on the job longer with less attention than any trap ever produced. Unless you live in Siberia, you can probably find a user around the corner who will tell you so from experience.

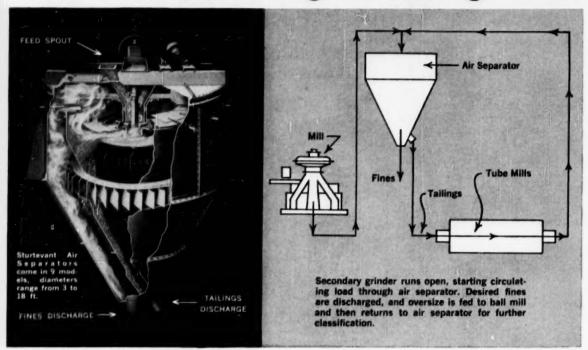
- 6. A trap should not be an "orphan". With Armstrong traps you can always get prompt service and parts from nearby Factory Representatives and stocking distributors as well as from the factory.
- 7. A trap should have a guarantee. The Armstrong trap is unconditionally guaranteed to give you complete satisfaction (as to doing its job, that is). If it doesn't, you can get your money back.

If you'd like to buy some of these excellent steam traps, call your local Armstrong Representative or write Armstrong Machine Works, 8587 Maple St., Three Rivers, Michigan.

ASK FOR the 44-page Steam Trap Book, free on request without obligation.



Stop Overworking Grinding Mills



PRODUCE UP TO 300% MORE 40 TO 400 MESH FINES — CUT POWER COSTS AS MUCH AS 50%

Fines that pass through grinding mills unhindered, serving only to increase the work load, can be quickly classified by a Sturtevant Air Separator operating in closed circuit. With all oversize automatically returned for further grinding, the result is production capacity impossible to achieve in single-pass grinding — as well as a better, more uniform product.

Closed circuit grinding and air separation is of proved advantage in all secondary reduction processes. Grinding mills are free to perform at top efficiency, their output frequently increased as much as 300% and power costs cut up to 50% (documented by 30 years of Sturtevant air separation experience in the cement industry). Further, attritional heat is dissipated by greater surface exposure.

Sturtevant Air Separators Keep Grinding Units At Peak Efficiency — Classify Feed Loads to 800 Tons Per Hour

Sturtevant Air Separators circulate production loads with exact control of air currents and centrifugal force. Simple adjustments make possible counter-action between the two to the point where a product of almost any desired fineness may be collected while coarser sizes are rejected.

A 16 ft. Sturtevant, for example, took a feed rate of 800 tph, containing only a small percentage of desired fines, and delivered 30 tph 90% 200 mesh, recirculating the oversize through the grinding circuit. (In the cement industry, Sturtevant units deliver up to 60 tph raw cement fines, 40 tph finished cement fines.)

Sturtevant's ability to engineer precise, high capacity classification for closed circuit grinding systems is the result of long experience with a wide variety of dry processes. Sturtevant designed its first air separator some 40 years ago — and has been pioneering developments in centrifugal classification ever since.

Current users of Sturtevant Air Separators include manufacturers of sulfur, soybeans, phosphate, chocolate, feldspar, sand, pigments, limestone fillers, abrasives, plasters, ceramics and cement.

Designed for precise separation of all granular materials, Sturtevant Air Separators have been adapted to other materials as well. Johns Manville, for example, uses a 10 ft. model to separate 3 to 6% undesirable rock from asbestos.

Ruggedly constructed, Sturtevant units are designed for minimum maintenance — at a Midwestern rock-crushing plant, a 10 ft. Separator operates outdoors year-round with only routine care.

For further information, request Sturtevant Bulletin No. 087. Write Sturtevant Mill Co., 100 Clayton St., Boston 22, Mass.

STURTEVANT

Dry Processing Equipment

CRUSHERS • GRINDERS • MICRON-GRINDERS
SEPARATORS • BLENDERS • GRANULATORS
CONVEYORS • ELEVATORS

July 1957—CHEMICAL ENGINEERING



"Keeping your ship on course"

At sea with your production problems? Make Piccolyte your helmsman. Because of their dependable uniformity, Piccolyte resins have repeatedly demonstrated their ability to keep production "on course" in the compounding industries.

Picco's experience helps users get the full benefit of the advantages provided by these terpene polymers. **Piccolyte's** high quality, its uniform pale color and its unusual stability solve many production problems. It is ideal for your raw material needs.

Piccolyte resins are available in a variety of softening points, and in mineral-spirits solutions.

Piccolyte resins are useful as a primary compounding ingredient in a wide variety of industries. Phone or write for complete data from the nearest Picco offices listed below.



PENNSYLVANIA INDUSTRIAL CHEMICAL CORP.

Clairton, Pennsylvania

Plants:

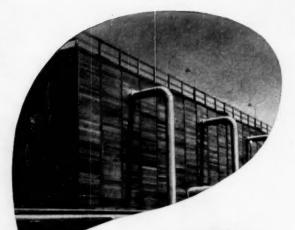
Clairton, Pa.; West Elizabeth, Pa.; and Chester, Pa.

Sales Offices:

Atlanta, Boston, Chicago, Cincinnati, Cleveland, Detroit, Jacksonville, Los Angeles, Minneapolis, New Orleans, New York, Philadelphia, Pittsburgh, San Francisca

Pritchard

INDUSTRIAL
COOLING TOWERS
HAVE NEW FEATURES
FOR BETTER
PERFORMANCE . . .
EASIER
MAINTENANCE



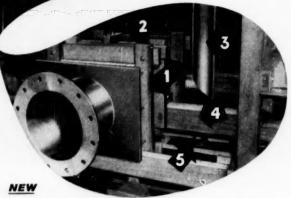


ELIMINATORS

The NEW drift eliminators in Pritchard counterflow cooling towers are supported from the framework for ease of erection and the slip-fit blades are easily removable for access to the laterals of the distribution system as illustrated. The drift eliminator sections over the main distribution header are removable in prefabricated units for quick servicing. These NEW eliminators are a full G-feet below the fan deck, providing a fan plenum chamber, with ample head room for easy servicing and inspection.

WRITE TODAY FOR FREE BROCHURE

Between the covers of "Answers to the 15 Questions About Pritchard Induced Draft Cooling Towers," you will find a wealth of helpful information. Information that will assist you in selecting your cooling tower. Write today on your company letterhead for your FREE copy. No obligation, of course.



DISTRIBUTION

SYSTEM

The Pritchard tower employs the closed All Heart Redwood distribution system providing better water distribution and trouble-free performance. To this time tested system have been added several NEW features:

- NEW Main Header... made of 1½" T&G with splined joints between panels for leak-proof construction.
- NEW Top Cover...panel is easily removed for inspection or clean-out-
- NEW Relief Vent... stand-pipe prevents damage from overpumping and eliminates danger of blowing out header.
- NEW Laterals...of simplified construction with splined joints. Each lateral has easy-to-remove end plug for fast, easy flushing.
- NEW Non-Clogging Distributors...made in one piece to assure steady, even flow of water over tower fill.

INDUSTRY'S PARINER FOR PROGRE

COOLING FOWER.

IN PRINCIPAL CITIES
FROM COAST

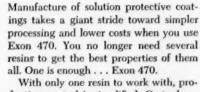
J.F. Pritchard & Co.

OF CALIFORNIA

Dept. 577, 4625 Rosnoke Parkway, Kansas City 12, Mo.



EXON 470...specifically for protective coatings at lower costs
...typical of the Pin-Pointed Properties in Exon Vinyl resins



With only one resin to work with, production control is simplified. Costs drop. At the same time you cut your inventory expenses. You produce a better product with outstanding solution characteristics.

Here are just a few of the important properties combined in Exon 470: Adhesion to metal, alkyd and vinyl surfaces. High solubility in aromatic hydrocarbons. Alkyd compatibility. Excellent pigment dispersion properties. Abrasion, acid and alkali resistance. Fast baking . . . medium fast drying. Oil, grease and salt-spray resistance. Low moisture vapor permeability. Outdoor durability. Now you need only one resin . . . Exon 470 . . . to make better solution coatings at lower costs.

Exon 470 is just one of the many resins in industry's most complete line of versatile vinyls. It is another reason why industry looks to Firestone for engineering answers to its needs.

Consider your own production problem. Then, for resin properties pin-pointed to the best answer for you, check with Firestone.

For complete information and technical service, call or write:

CHEMICAL SALES DIVISION: FIRESTONE PLASTICS COMPANY

DEPT. 728J, POTTSTOWN, PA. • A DIVISION OF THE FIRESTONE TIRE & RUBBER CO.

INDUSTRY'S MOST COMPLETE LINE OF VINYLS ENGINEERED TO YOUR SPECIFIC NEEDS



Firesto

RESINS

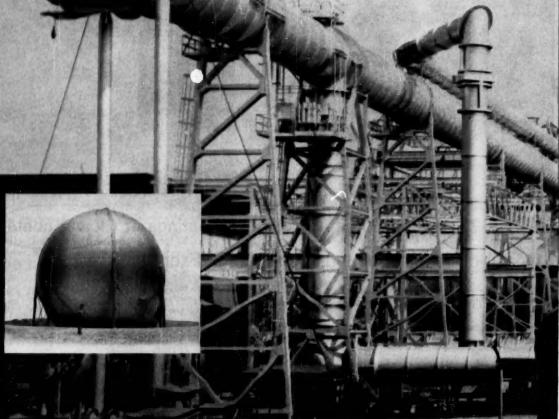
PLATE **FABRICATION AND** ERECTION of vessels, tanks, towers, odd and intricately designed

chemical equipment...to any size...of any material: steel, aluminum,

stainless, stainless-clad, special alloy, etc.

HAMMOND IRON WORKS has a background of more than 50 years' successful service to the chemical industry. With its 5 plants and its know-how, based upon experience, no job is too large or too small for Hammond.

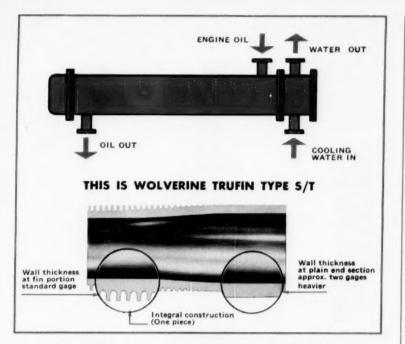
> Catalog 54B illustrates the Hammond story . . . write for your copy.



WARREN and BRISTOL, PA. . PROVO, UTAH CASPER, WYOMING . BIRMINGHAM, ALABAMA

Sales offices throughout the U. S. A.; licensees and sales offices in many foreign countries including Argentina, Belgium, Brazil, Canada, Columbia, Egypt, England, France, Haiti, Italy, Japan, Mexico, Netherlands, Peru and West Germany.





Trufin-Tubed Engine Oil Cooler Provides Maximum Performance—Minimum Upkeep

BY ERNEST DODD

Most of the time, cooling engine oil is the kind of job refinery men would just as soon do without. In most cases it's a dirty service — requires frequent cleaning of tube bundles and, because it is primarily a maintenance cost item — it doesn't produce a profit.

But like it or not—it has to be done—and here are the details of how engineers in a Texas refinery have removed much of the difficulty usually encountered in this type of work.

Four years ago, this firm put in service a heat exchanger tubed with 172 eight-foot lengths of Wolverine Trufin®—Type S/T—the integrally finned condenser tube. This exchanger operates next to identical units tubed with prime surface tube.

In the intervening years, the Trufin unit has cooled the engine oil to the desired temperature without difficulty. Although the service is regarded as dirty on the shell side, this Trufin-tubed exchanger has outperformed the bare tube units — has remained on stream three to four times longer before cleaning was required. The reduction in maintenance because of this has been sub-

stantial and has resulted in welcome savings.

The ability of Trufin Type S/T to take fouling in its stride is well substantiated. Engineers have discovered that the configuration of Trufin's extended surface is apparently less conducive to scale build up than that of plain tube. Scaling tends to follow the contour of the fins and does not accumulate preferentially between the fins, instead the scaling forms an extended projection of the fin. In many cases Trufin appears to be self shedding.

In this particular refinery, engineers are so pleased with the results on engine oil coolers that as each cooler requires retubing the prime surface tubes are being replaced with moneysaving, performance-boosting Wolverine Trufin Type S/T—the condenser tube with the integral fins.

TYPE S/T HAS 150% THE SURFACE OF PLAIN TUBE

Big statement?

No siree — just the plain unvarnished truth. Wolverine Trufin Type S/T — the integrally finned condenser tube—has approximately 1½ times—or 150% — more surface area than a piece of plain tube of equivalent length and diameter. In addition it has an external to internal surface ratio of 3½ to 1.

Trufin Type S/T cannot be used indiscriminately in all heat exchanger applications with economic advantage. BUT—if your heat exchanger operations include any of the following (to name but a few) those are mighty important figures—the kind that can help you achieve big increases in heat transfer performance:

- Condensing Freon and other refrigerants.
- 2 Condensing hydrocarbons.
- 3 Condensing organic chemicals.
- 4 Evaporating Freon-water chillers.
- 5 Boiling hydrocarbons.
- 6 Heating or cooling gases.
- 7 Heating or cooling lube oils, transformer oils, absorber oils and quench oils.

And that isn't all.

Wolverine Trufin Type S/T is equally effective in both old and new equipment. In new equipment, Trufin Type S/T permits you to design smaller, more powerful units — with a consequent savings in direct tube costs, as well as in smaller shells, heads, baffles and labor, etc. If the units are to be used in overhead service there is also a substantial saving in weight which in turn means lighter superstructures.

When retubing existing equipment, Trufin Type S/T permits you to pack more heat transfer surface into a given area — steps up the capacity of your present exchangers and condensers.

Next time you're considering new equipment—or retubing old—remember Wolverine Trufin Type S/T. It can be your key to greater heat transfer efficiency with greater economy.

SEND FOR FREE BOOK

Wolverine's Condenser Tube Catalog contains much valuable information concerning alloys, corrosion, types of tube, tubing applications, etc. Write—today—for your free copy.

Wolverine Trufin is available in Canada, through the Unifin Tube Company, London, Ontario.

CALUMET & HECLA, INC.

CALUMET DIVISION
WOLVERINE TUBE DIVISION
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GOODMAN LUMBER COMPANY
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EQUIPMENT COMPANY LIMITED

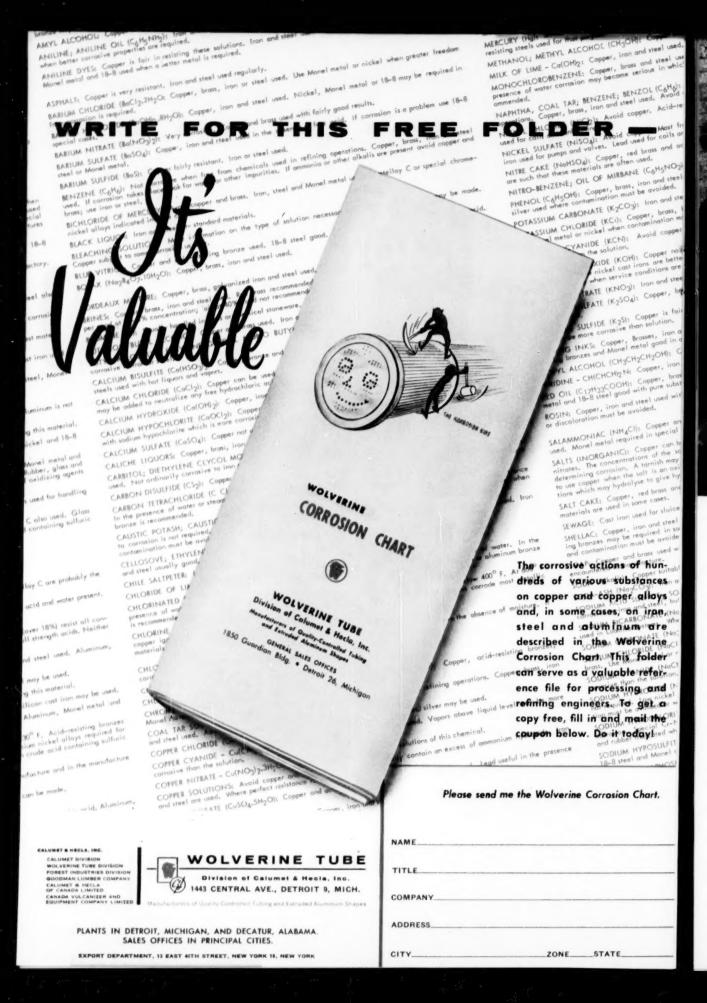


WOLVERINE TUBE

Division of Calumet & Hecia, Inc. 1443 CENTRAL AVE. DETROIT 9, MICH.

PLANTS IN DETROIT, MICHIGAN, AND DECATUR, ALABAMA. SALES OFFICES IN PRINCIPAL CITIES.

EXPORT DEPARTMENT, 13 EAST 40TH STREET, NEW YORK 16, NEW YORK





FALK STEEL Shaft Mounted Drives

Wherever you require a highly efficient, economical speed reducing unit to fit into a limited space, the FALK All-Steel Shaft Mounted Drive meets your needs perfectly. This rugged, compact reducer mounts directly on the driven shaft and is driven through V-belt or chain drive from any convenient rotating power source.

It's hard to match the versatility of a Falk Shaft Mounted Drive. You can choose a single or double reduction unit and use it with any of the many possible sheave or sprocket ratios to obtain almost any specified speed between 420 and 10 rpm. Equally important, the standard Falk Shaft Mounted Drive is available for horizontal and vertical application. Delivery is immediate, installation is quick and easy.

These units are completely FALK-designed and FALK-built for a long life of dependable, trouble-free service. Precision-cut helical gears of highest efficiency are employed for efficient, quiet operation.

> Always available promptly from factory and distributor stocks, from coast to coast. For details, ask your Falk Representative or Distributor—or write for Bulletin 7101.

THE FALK CORPORATION, 3001 W. CANAL ST., MILWAUKEE 1, WIS. Representatives and Distributors in Most Principal Cities

- Motoreducers
- · Speed Reducers anufacturers of
 - - Flexible Couplings

 - Shaft Mounted Drives
- · High Speed Drives
- · Special Gear Drives
- Single Helical Gears
- · Herringbone Gears
- Marine Drives
- Steel Castings
- Weldments
- Contract Machining

SIX SIZES-1/2 to 30 HP-420 to 10 rpm-single and two double reduction ratios. Output torque ratings up to 21,000 lb-in.

A FEW OF THE MANY **APPLICATION FEATURES**





VARIABLE SPEEDS through use of variable-pitch sheaves -automatic helt adjustment with tie-rod adjustment

OVERLOAD RELEASE that will slacken belts and cut off power if overload occurs



...a good name in industry

HOW HERCULES HELI



GROW BETTER COTTON-Early season insect control with toxaphene insecticides helps farmers produce healthy bolls before the time of greatest infestation. Toxaphene has long been the keystone of complete control programs because it

effectively and economically controls a large number of insect pests on a wide variety of crops. For example, toxaphene is officially recommended for control of more cotton insects than any other insecticide.



VITAMIN TABLETS—Purity is a must for such products as Abbott Laboratories multivitamin tablets. Hercules[®] cellulose gum serves as a disintegrator in these tablets; helps to quickly release the vitamins into the system. The exceptionally high purity of Hercules cellulose gum (99.5+%) and its uniform quality make it ideal for many medicinal preparations.



SELL FINE FURNITURE-Most furniture is naturally protected and beautified with fine lacquer for lasting beauty and durability. Hang tags like this are available at nominal cost through the many lacquer manufacturers who base their finishes on Hercules® nitrocellulose. These tags also tell how to take care of the lacquer finish.



HERCULES POWDER COMPANY

952 Market St., Wilmington 99, Delaware

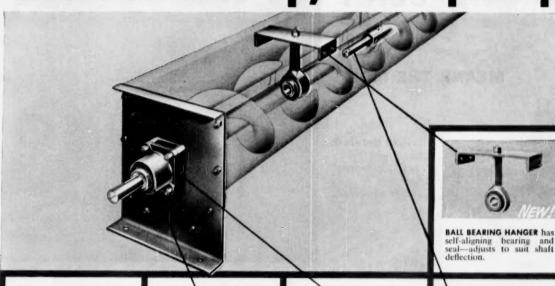
CHEMICAL MATERIALS FOR INDUSTRY



July 1957--CHEMICAL ENGINEERING

Why screw conveyors with

NEW LINK-BELT components demand less hp, less upkeep





BALL AND ROLLER BEARING COUNTERSHAFT END connects two conveyors at right angles . . permits use of a right-angle drive.



DOUBLE BALL BEARING TROUGH END supports shaft at two points. Resists overhung loads at drive end and takes thrust loads of screw.



SPACER BLOCK keeps grease in, dirt out. Used with lip, felt or waste packing seal to prevent bearing-product contact.



OUIK-LINK CONVEYOR SCREW. For ease in removal of conveyor section without disturbing other components.

For new or existing systems . . . LINK-BELT offers a complete line of accessories — many featuring ball and roller bearings

Here's a complete line of screw conveyor components designed to bring you smoother performance—reduce downtime and maintenance. Countershaft ends, as well as new trough ends and hangers, use Link-Belt precision ball and roller bearings to reduce starting and running friction . . . lower power requirements.

The new trough end spacer block with seals protects bearings — prevents product contamination by grease and other foreign matter. Spacer is rabbetted for perfect alignment with bearings. Other refinements include Link-Belt Motogear drives for mounting on top of conveyor . . . and the Quik-Link conveyor screw that makes removal of conveyor section possible without disturbing other components.

For facts, call your nearby Link-Belt office or authorized stock-carrying distributor. Or write for Folder 2489.





complete motogear power unit permits direct mounting on top of conveyor. In sizes up to 20 hp.

LINK- BELT

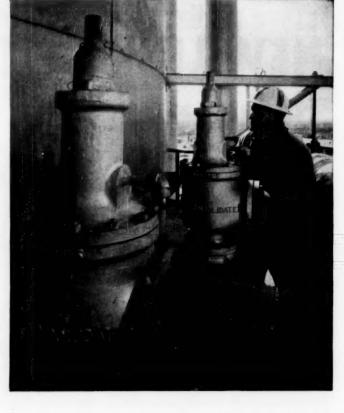
SCREW CONVEYORS

LINK-BELT COMPANY: Executive Offices, Prudential Plaza, Chicago I. To Serve Industry There Are Link-Belt Plants, Sales Offices, Stock Carrying Factory Branch Stores and Distributors in All Principal Cities. Export Office: New York 7; Canada, Scarboro (Toronto 13); Australia, Marrickville, N.S.W.; South Africa, Springs. Representatives Throughout the World.

WHAT YOU DON'T SEE MEANS THE MOST



...in service
...in economy
...in protection



Few Functional Parts. Each part is precision machined and aligned to assure long valve life and minimum maintenance.

Economical "2 in 1" Design. Construction that permits you to convert the Standard valve to the Bellows type in your own shop.

Only One Adjusting Ring. Easy to set before the valve is installed to obtain peak performance at 4-5% blowdown. Whatever the ring position, full relieving capacity is certain because a fixed maximum secondary orifice provides full lift at 10% over-pressure. Even with "superimposed" back pressure in the relieving system, valve action is consistently positive.

Temperature-Compensating Disc. Temperature-induced stresses cannot distort the seat. Seating is always tight, even when nominal strains of unanchored discharge piping are present. Minimum guiding area is provided to align the seating sur-

faces — less chance of a sticking disc holder when corrosion or contamination build up on the guiding surfaces. The seating surfaces are optically-ground flat — servicing is easier, highly economical.

Huddling Chamber and Secondary Orifice Contours take full advantage of the stream pressure and kinetic forces – an exclusive safety feature.

Low-Placed Threaded Section Holds Nozzle in Valve. Assures high resistance to discharge of piping strains. No leakage from strain induced into the nozzle.

Standardized Inlet-Outlet Face-To-Face Dimensions permit easy interchangeability with the valves of some other manufacturers.

Certified and Approved. Both Standard and Bellows Valves – in the full range of sizes and pressures – are approved under ASME Unfired Pressure Vessel Codes and are certified by the National Board of Boiler and Pressure Vessel Inspectors.



Absolute protection for personnel and facilities . . . far fewer inventory and maintenance needs . . . long-term economy. Be assured on every count before you buy another safety relief valve. Investigate fully the quality of Consolidated Safety Relief Valves—then compare. Write for Catalog 1900.

In Canada: Manning, Maxwell & Moore of Canada, Ltd., Galt, Ontario.

CONSOLIDATED RELIEF VALVES



A product of MANNING, MAXWELL & MOORE, INC. TULSA, OKLAHOMA

MAKERS OF 'AMERICAN' INDUSTRIAL INSTRUMENTS, 'ASHCROFT' GAUGES, 'CONSOLIDATED' SAFETY VALVES, 'AMERICAN-MICROSEN' INDUSTRIAL ELECTRONIC INSTRUMENTS, Stratford, Conn. 'HANCOCK' VALVES, Watertown, Mais. 'CONSOLIDATED' SAFETY RELIEF VALVES, Tulsa, Okia, AIRCRAFT CONTROL PRODUCTS, Danbury, Conn. and Inglewood, Calif. "SHAM-80X" AND 'LOAD LIFTER' CRANES, 'BUDGIT' AND 'LOAD LIFTER' HOISTS AND OTHER LIFTING SPECIALTIES, Muskegon, Mich.



Efficient hot line insulation is lightweight, easy to handle

Specially designed for hot lines operating up to 400°F., Armstrong Armaglas* Pipe Covering goes on fast, provides extra-efficient protection. Armaglas is made of glass fibers bonded together with a heatresistant resin; it has a density of only 7½ lbs. per cubic foot for light, easy handling. The resilient fibers mesh together at joints to give unbroken, continuous protection.

Armaglas Pipe Covering comes in 3' sections for pipe sizes up to 33" and copper tubing up to 6". It is available with a variety of interior and exterior type jackets.

Armaglas Pipe Covering is one of the many fine products in the complete line of Armstrong Industrial Insulations. Armstrong also offers you a contracting service, geared to install these products efficiently.

Armstrong INSULATIONS

for temperatures from -300° F. to $+2800^{\circ}$ F.

* B ARMSTRONG CORK COMPANY, MANUFACTURED BY OWENS-CORNING FIBERGLAS CORP.

Free Booklets



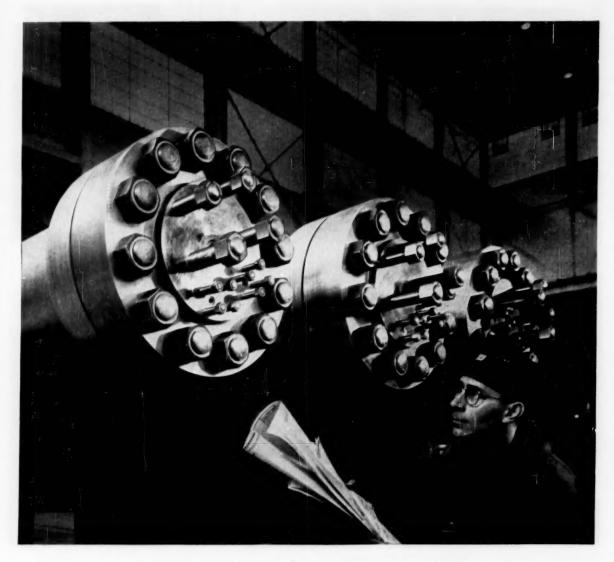
Armstrong Armaglas Insulations (data sheets)

Armstrong Armatemp* Block and Blankets

Armstrong Armaflex®, a Flexible Pipe Insulation

Armstrong LT Cork Covering for Cold Lines

For full information send for free literature. Write to Armstrong Cork Company, 2307 Sharpe Street, Lancaster, Pennsylvania.



These three will help make synthetic fibers

The three forged separators shown above will be used in the making of synthetic fibers. They will handle pressures between 8,000 and 9,000 psi.

Built by Bethlehem, the vessels are almost in the midget class. They do not have to be big for the work they will do. Each of them is 94 in. long and weighs approximately two tons. But there is an old saying that good things come in small packages,

and this is a case in point. The vessels, though small, are exceptionally sturdy. Every component is strong, down to the last stud and nut.

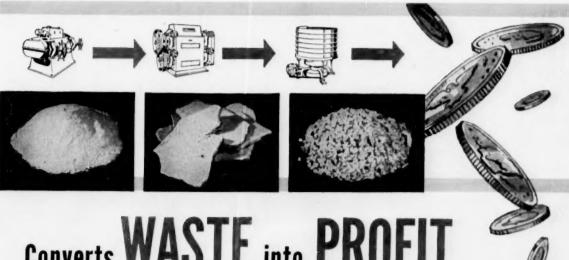
It's quite possible that you yourself may never need to purchase vessels as small as these. But Bethlehem can handle your requirements, whatever they may be. We are equipped to forge, heat-treat, and machine pressure vessels of any size, even those weighing 150 tons and more. When you are planning separators, autoclaves, reactors, filters, converters, or high-pressure accumulators, feel free to consult with our staff of engineers. You will find these technicians helpful, cooperative, and able to work in complete harmony with your own people.

BETHLEHEM STEEL COMPANY BETHLEHEM, PA.

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation Export Distributor: Bethlehem Steel Export Corporation

BETHLEHEM STEEL



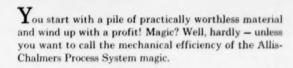


Converts WASTE into PROFIT

ALLIS-CHALMERS Compacting **Process**

it's mechanical

it's economical



How It Works

In a recent installation the conversion starts with an unusable, unacceptable minus 30 mesh chemical salt . . . fines created in the original process. An Allis-Chalmers compacting mill densifies these fines into flakes or slabs. Flakes are granulated in an Allis-Chalmers roller mill. Final separation is made in an Allis-Chalmers stainless steel gyratory screen. Result - 70 to 80% recovery of salable product. What's more - the resulting granules equal or surpass the natural product in every respect.

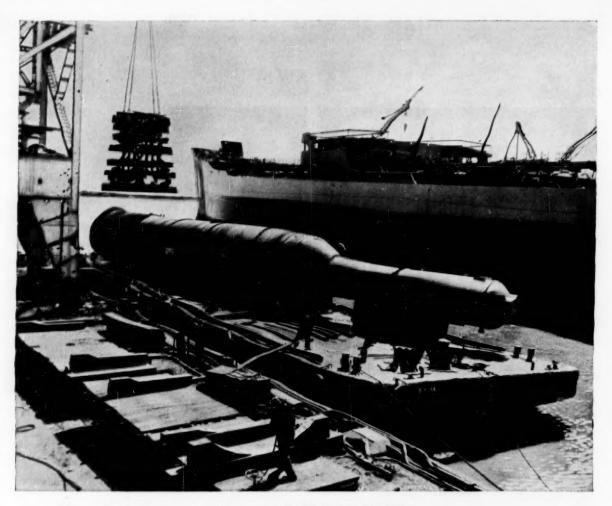
The entire system is mechanical; therefore, it's more economical than controlled crystal growth.

For More Information

Get the complete story from your A-C representative or write Allis-Chalmers, Industrial Equipment Division, Milwaukee 1, Wisconsin. Ask for Bulletin 25C6177J.

ALLIS-CHALMERS





standard procedure: VERSATILITY...

The variety of work which Sun Ship's integrated shops produce for use by industries on land and sea brings a matching variety of shipping problems.

Our facilities for tidewater shipment are used to economical advantage on many of the massive structures that go into the making of the nation's petroleum and chemical industries. The barge shipment of tower and shed row baffles, shown above, is a good example.

And of course-when shipment by land is

necessary-Sun Ship rigging and routing find the ways and means to handle such items as large-diameter columns by rail and truck.

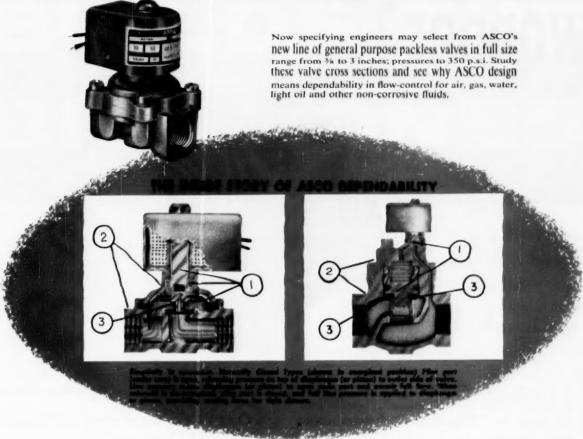
It's all a part of the versatility which forty years' experience has made part of "standard procedure" in service of its customers.

Our Sales Engineering Department would be glad to use its experience in helping you overcome any problem of construction or shipment that faces you. Write



ON THE DELAWARE SINCE 1916 CHESTER, PA.

new complete line of ASCA 2-way solenoid valves now available in full range through 3" sizes



Bulletin 8210A %"-34" sizes

- Simplicity in construction. Only three operational parts: all stainless steel core, stainless steel spring, Hycar diaphragm (for handling all common liquids and gases).
- Ruggedness. Forged brass bonnet and body insure freedom from porosity.
- Tight Shut-Off. Assured by resilient disc construction.
- Compactness. 2¾" face to face; 3¼" pipe center line to top of solenoid; 3 13/16" overall height. (Normally closed, ¾" x ½" sizes.)
- Mountable in any position, normally open or normally closed.

Bulletin 8210A 11/4"-3" sizes

- Simplicity in construction. Even in larger port sizes, moving assemblies have been held to two bronze piston and stainless steel core.
- Ruggedness. Extra heavy duty bronze body and bonnet, plus heavy duty operating parts.
- Tight Shut-Off assured by resilient disc construction.
- Elimination of water hammer assured by slotted "V" type discs.

All sizes have full area ports, continuous duty coils designed for low temperature rise and long life, and are available normally open or normally closed with standard, water tight or explosion proof solenoid.

Whatever the crucial factor in your flow-control application — reliability, compactness, high cycling rate — there is an ASCO valve that meets your need.

Write for Catalog 201 covering ASCO line of solenoid valves.

Automatic Switch Co. ASCA

50-D Hanover Road, Florham Park, New Jersey



why wonder?



You can be sure you're getting a ready-to-go steam trap when you buy a Nicholson... because each and every one is tested in actual steam service before shipment.

And that's not all. With just one thermostaticallyoperated moving part, there's nothing to get out of order, nothing to go wrong. Nicholson means continuous operation of your steam-using equipment ... no downtime from trap failure.

- high air-venting capacity . . . for faster warmup of equipment.
- powerful valve action . . . no mechanical linkages to cause trouble.
- · small and lightweight . . . easy to pipe and support.

So, to get a trap that's service-tested, and loaded with operating features, specify Nicholson. W. H. NICHOLSON AND COMPANY, 14 OREGON ST., WILKES-BARRE, PA., Sales and Engineering offices in 98 principal cities.



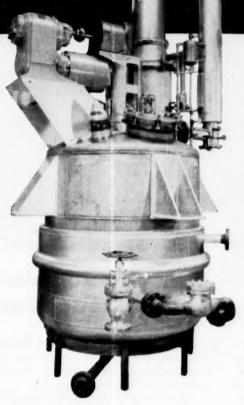
BRIGHTON BUILDS THE BIG ONES

Process Mixing Kettles

This Dowtherm-heated, 1000-gallon mixing kettle, designed and fabricated by Brighton, includes these outstanding features:

■ Maximum internal working pressure 40 psi. and/or full vacuum, maximum jacket pressure 80 psi. ■ Variable speed agitator which can be regulated according to viscosity of material being processed. ■ Solvent condenser to provide easy adaptation for solvent cooking. ■ Entire kettle fabricated of stainless steel for greater corrosion resistance.

At Brighton, we have the facilities and skilled metalsmiths to build chemical processing equipment of any size—laboratory models to full scale. Typical jobs include heat exchangers, fractionating columns, reactors, pressure vessels, coils, agitators, kettles, tanks and evaporators. Brighton craftsmen are skilled in working all types of ferrous and non-ferrous alloys. They build with precision to your exact specifications. For complete information call GRandview 1-4110, or write.





BRIGHTON CORPORATION

820 State Avenue, Cincinnati 4, Ohio

Serving the Paint and Varnish and Chemical Process Industries since 1914



How to get more storage space with BLAW-KNOX Electroforged® Steel Grating

You can get additional badly needed storage space easily and economically in your present building simply by installing platforms of Blaw-Knox Grating. It fits easily, neatly around pipes, beams and machinery without any alterations to your building.

Maintenance costs are slashed into the bargain. There's nothing to wear, nothing to patch. Blaw-Knox grating is self cleaning too. No sharp corners to clog up with dirt, and you'll find painting is easy since all surfaces are easily accessible.

You get maximum open area for plenty of light and ventilation. What's more, its rigid one-piece construction means maximum structural strength and load bearing capacity.

Blaw-Knox Electroforged Grating for walkways, stair treads and floors is fabricated to your specifications to meet your own operating requirements. Complete data on all types is contained in Bulletin 2527. Write for your copy today.



BLAW-KNOX COMPANY

Blaw-Knox Equipment Division Dept. C, Pittsburgh 38, Pa.



Series 2800

Liquid Level CONTROLS

For use as high and low limit switches, to sound alarms, flash signal lights, start or stop fluid transfer pumps, or to operate control valves.



Series 2800 are dependable, inexpensive, snap acting liquid level controls. They are float actuated and, for maximum versatility, are available with either electric (explosion-proof) or pneumatic switch action. Either pilot type is interchangeable on the same float housing assembly. Stab-in type of tank mounting provides easy installation. Available with 4" iron or steel flanged tank connection.

Write for Bulletin F-2800 for complete information.

FISHER GOVERNOR COMPANY Marshalltown, lowa · Woodstock, Ontario



As filled capsules are inspected at Abbott Laboratories, North Chicago, Illinois, the girl suits the speed of the Jeffrey feeder to her requirements with the hand rheostat.

A way to do what "can't" be done... JEFFREY Vibrating Feeders

Jobs once considered too costly, too hazardous, or just plain impossible are being done with Jeffrey electric vibrating feeders . . . handling a tremendous variety of materials, densities from 4 to 400 pounds per cubic foot, one micron in size to four-foot cubes, a few ounces to 2,000 tons per hour.

With Jeffrey feeders, the operator has instant and absolute control

With Jeffrey feeders, the operator has instant and absolute control over the flow of material. This control may be manual or automatic, depending upon equipment that follows, to insure optimum loading. Thus a plant and its workers can produce at top efficiency.

Jeffrey engineers are expert in applying vibrating equipment to all types of processes, and are available to help solve your feeding and conveying problems. Catalog 870 describes these feeders. The Jeffrey Manufacturing Co., 909 North Fourth St., Columbus 16, Ohio.



FEED

FLOW CONTROL is possible within wide limits, simply by changing feeder's amplitude of vibration.

CONVEYING • PROCESSING • MINING EQUIPMENT...TRANSMISSION MACHINERY...CONTRACT MANUFACTURING



IT'S **EC**&**M** FOR A <u>COMPLETE</u> LINE OF SYNCHRONOUS MOTOR STARTERS!

FOR ALL LOW VOLTAGES
AND FOR 2200-4800 VOLT
POWER SYSTEMS!

Here's Why EC&M Pushbutton Automatic Starters Do The Job Better...

Complete protection during starting, acceleration and while running at synchronous speed.

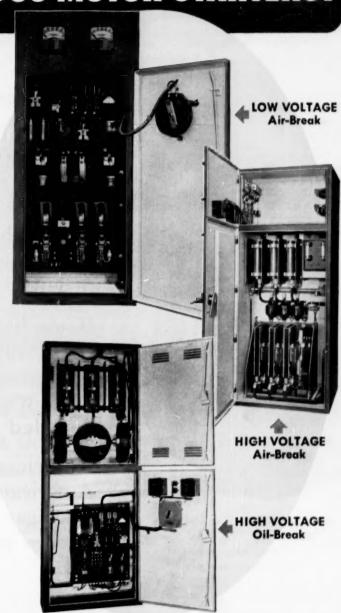
Motor pulls into step without delay because field is applied under best conditions for synchronization.

Automatic field removal and resynchronization allow motor to accelerate and re-synchronize after voltage dip or momentary overload.

Easily installed because all internal wiring is complete.

Full or reduced voltage starting
All high voltage starters available
in 3 ratings: (1) 50,000 KVA (certified) interrupting capacity—(2) with
power-type, current-limiting fuses
—(3) VALIMITOR® (volt-ampere-limitor), the bus may be of unlimited KVA.

Write for Bulletins 8200 and 8820





THE ELECTRIC CONTROLLER & MFG. CO.

A DIVISION OF THE SQUARE D COMPANY
CLEVELAND 28 - OHIO

8587

n American Blower 250-hp single-stage centrifugal compressor like this one has been in operation as a cupola blower in a foundry for more than 25,000 hours. Not once has it been down for repairs.



Dependable performance like this is typical of American Blower Centrifugal Compressors. They're available in single-stage sizes—35 to 2500 hp; pressures from ³/₄ to 7¹/₂ lb. (psig); volumes from 2500 to 140,000 cfm.

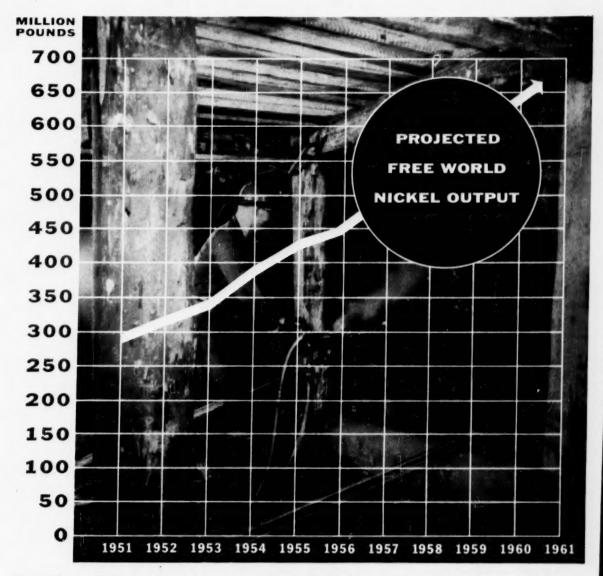
If you have a problem involving the application of centrifugal compressors, why not get in touch with our nearest branch for detailed product information?

American Blower Division of American-Standard, Detroit 32, Michigan. In Canada: Canadian Sirocco products, Windsor, Ont.

AMERICAN BLOWER

Division of AMERICAN-Standard





Another 50% advance in nickel industry's production capacity

Paced by Inco-Canada's new developments in Manitoba, producers put 1961 Free World nickel output at 650-675 million pounds a year—up 130% over 1951

In 1951, the nickel industry of the Free World produced about 290 million pounds of nickel.

Last year, the over-all output of the industry set a new record high of 450 million pounds.

This was an expansion of more than 50% in five years: a substantial production boost that indeed benefited industry, but only after vital defense and government stockpile needs were given preference.

New Inco-Canada developments help set new goals

Right now Inco-Canada, with years of exploration behind the project, is pushing construction at its new Manitoba mines: developing in the far North a new, big-tonnage nickel-producing area.

In Ontario, at the same time, Inco-Canada is continuing to expand its Sudbury capacity.

In 1961, this should lift Inco-Canada's nickel output to 385 million pounds a ye r. A hundred million more than in

With the steadily increasing capacity

of all Free World producers, in the next four years nickel production should be lifted to the all-time high of 650-675 million pounds a year.

With 1961 capacity anticipated at more than twice what it was in 1951and with continuing exploration-nickel users are assured of more nickel in their future.

The International Nickel Company, Inc., New York 5, N. Y.

© 1957, T. I. N. Co., Inc.



International Nickel

The International Nickel Company, Inc., is the U. S. affiliate of The International Nickel Company of Canada, Limited (Inco-Canada)—producer of Inco Nickel, Copper, Cobalt, Iron Ore, Tellurium, Selenium and Platinum, Palladium and Other Precious Metale Inco-Canade) - producer of Inco Nickel, Copper, Cobalt, and Platinum, Palladium and Other Precious Metals

How to simplify control problems

Keep systems flexible, carry small inventory, cut maintenance cost with the Bailey Building Block Method of instrumentation and control.

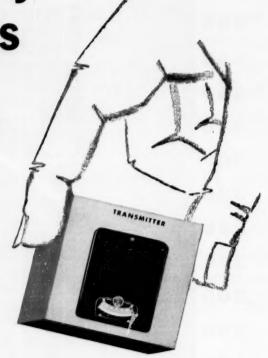
What is the Bailey Building Block Method? It's using standardized Bailey measuring, transmitting, and controlling components and combining them into any system you need. Components can be added as needed . . . removed and reused elsewhere . . . recombined into another system when the need changes. It's flexibility plus!

It's all based on the simple fact that a Bailey instrument or control component doesn't care if the measured variable is steam flow, tank level, or tower temperature, to pick just three examples. System components-transmitters, receivers, relays, selector stations, power units-are standardized for multi-purpose use.

A spare component can be used in any one of many systems. Gone are delays waiting for shipments of special parts. Gone are large inventories of spares and parts. Simplified is the training of men for maintenance.

There are many exclusive features and advantages of the individual components used in the Bailey Building Block Method. And there's much more to the Building Block story itself.

For further details, call our local district office or write us at Cleveland. Our engineers will be glad to prove how the Building Block approach will save you money and simplify your instrument and control problems.

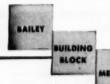












BAILEY METER COMPANY 1054 IVANHOE ROAD, CLEVELAND 10, OHIO

In Canada — Bailey Meter Company Limited, Montreal

RESULTS IN: PLEXIBILITY, SIMPLICITY, ECONOMY



Where dependability is at a premium...



FW Vaporizer at AUTOMATED Gasoline Plant gives trouble-free operation in virtually unattended service

At the Ropes Field Plant, operated by Honolulu Oil Corp., slightly less than 2000 MCF of gas per day were available for processing -- hence capital expenditure and operating costs for this isolated gasoline plant had to be kept to an absolute minimum. Process heating is provided by a FW vaporizer using Para-Cymene which operates at only 380 F, 8 psig! Designed for maximum automation and a minimum operating force, the Ropes installation has fully lived up to the owners' expectations for dependability and economy of operation.

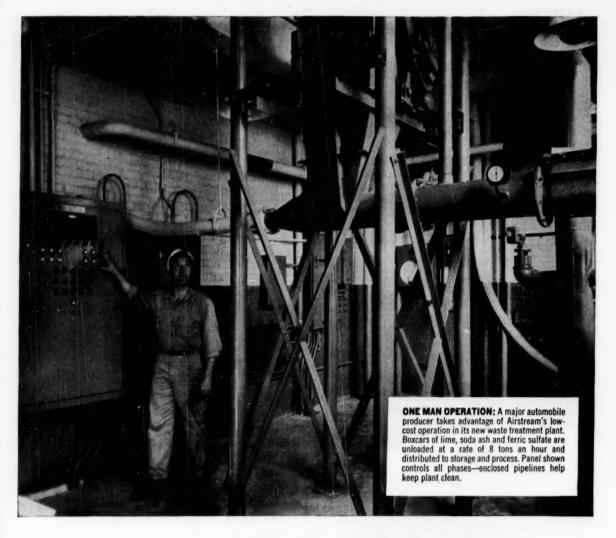
high-temperature, low-pressure units HEAT-ENGINEERED by FW prevent outages – cut maintenance

Over a period of 23 years, Foster Wheeler engineers have recognized that an entire process system should be analyzed before recommending the proper high-temperature, low-pressure vaporizer. This application engineering "beyond the vapor outlet" assures a vaporizer that's right for the job — perfectly matched to a heating system with the most efficient and dependable piping arrangements, circulation method and thermal design.

Another advantage is that only Foster Wheeler does the complete job — designs and builds the vaporizer, installs it in your plant, puts it "on stream", and follows through with checkups and service to assure continued top performance under changing conditions of operation. For further information, send for Bulletin ID-54-5. Foster Wheeler Corporation, 165 Broadway, New York 6, N.Y.

FOSTER WHEELER

NEW YORK . LONDON . PARIS . ST. CATHARINES, ONT.



how to unload and distribute bulk chemicals automatically

- Industrial process and treatment chemicals are usually purchased in bulk. Unloading these materials and conveying them to storage or distributing to process creates a major handling problem. Many conveyors have been devised to handle these materials, but for plants using as little as one carload a month none has as many cost-saving advantages as a Dracco Airstream Conveyor:
- LOW LABOR COSTS: Manual handling is eliminated. Central panel and unloading devices normally require only parttime attention of one man.

Dracco Bulletin 529, "Airstream Conveyors", contains detailed information on equipment and uses. Shows examples. For your copy, write Dracco today.

- MULTI-STAGE OPERATION: Airstream Conveyors can unload materials at high speeds, convey them by suction or pressure to storage, remove them from storage to process, weigh and batch moving materials en route.
- HANDLE MULTIPLE MATERIALS: Flexibility of Airstream Conveyors permits unloading of two or more materials in quick succession into proper storage bins without intermixing.

• NO DUST OR CONTAMINATION: Enclosed conveying lines keep all materials in, foreign matter out. Self-cleaning action of pipelines cuts maintenance to a minimum. Waste and spillage are eliminated.

If you are planning new facilities which will require handling of bulk chemicals —or any dry bulk material—consider the advantages of an Airstream Conveyor. For more details, write or call Dracco today.

DRACCO CORPORATION
4040 East 116th Street · Cleveland 5, Ohio

DRACCO

airstream conveyors
dust control equipment

from abrasive slurries to delicate foods...

MOYNO PUMPS

CUT HANDLING COSTS



The Moyno "progressing cavity" pumping principle has enabled thousands of plants to pipe difficult materials that were transported by hand and other expensive means. Moyno is the only pump that can handle many abrasives, pastes, slurries, chemicals, foods, suspended solids, etc., without foaming, aerating, crushing or excessive pump wear.



As shown above, Moyno Pumps have a screw-like rotor that revolves in a double threaded stator creating progressing cavities which smoothly move material through the pump. They will pump anything that will move through a pipe . . . even plaster and non-pourable pastes!

Moyno Pumps are available in capacities up to 500 gpm and pressures up to 1000 psi.

Examine your processing methods. No doubt there are several places where Moyno Pumps can drastically cut costs. Ask us, we'll give you a frank answer. Send us an outline of your problem today! Write for Bulletin 30-CE.



ROBBINS &

E MYEKS, IN













Motors



Moyno Pumps Progettair (Industrial) Fans



The ability of Nash Compressors to maintain original performance over long periods is no accident. Nash Compressors have but a single moving element, the Nash Rotor. This rotor is precision balanced for long bearing life, and it revolves in the pump casing without metallic contact. Internal lubrication, frequent cause of gas contamination, is not employed in a Nash. Yet, these simple pumps maintain 75 lbs. pressure in a single stage, and afford capacities to 6 million cu. ft. per day in a single compact structure.

Nash Compressors have no valves, gears, pistons, sliding vanes or other enemies of long life. Compression is secured by an entirely different principle of operation, which offers important advantages often the answer to gas handling problems difficult with ordinary equipment.

Nash Compressors are compact and save space. They run without vibration, and compression is without pulsation. Because there are no internal wearing parts, maintenance is low. Service is assured by a nation-wide network of Engineering Service offices. Write for bulletins now.

No internal wearing parts. No valves, pistons, or vanes. No internal lubrication. Low maintenance cost. Saves floor space. Desired delivery temperature Automatically maintained. Slugs of liquid entering pump will do no harm.

75 pounds in a single stage.

NASH ENGINEERING COMPANY
312 WILSON, SO. NORWALK, CONN.

You Can Pump in controlled volume

HYDROCHLORIC ACID...all concentrations
CHLORINATED HYDROCARBONS
CORROSIVE METALLIC SALT SOLUTIONS

DILUTE ACIDS
MIXED ACIDS
WITH

Lapp PULSAFEEDER

COMPLETELY NON-METALLIC CONSTRUCTION

AND

NO STUFFING BOX TO LEAK



Solid Lapp Chemical Porcelain, combined with parts of alumina ceramic and Teflon plastic, is used for the liquid end of this model of Lapp Pulsafeeder. All parts which can come in contact with liquid being pumped are non-metallic, chemically inert. Thus, positive-displacement metered pumping of "hard-to-handle" corrosive chemicals is made certain and permanently trouble-free.

WRITE FOR BULLETIN 440 with typical applications, flow charts, description and specifications of models of various capacities and constructions. Inquiry Data Sheet included from which we can make specific engineering recommendation for your processing requirement. Write Lapp Insulator Co., Inc., Process Equipment Division, 574 Poplar St., Le Roy, N. Y.

Lapp

Lapp Pulsafeeder is the combination piston-diaphragm pump for controlled-volume pumping of fluids. Reciprocating piston action provides positive displacement. But the piston pumps only an hydraulic medium, working against a diaphragm. A floating, balanced partition, the diaphragm isolates chemical being pumped from working pump parts—eliminates need for stuffing box or running seal. Pumping speed is constant; variable flow results from variation in piston-stroke length—controlled by manual hand-wheel, or, in Auto-Pneumatic models, by instrument air pressure responding to any instrument-measurable processing variable.



ARE YOU GETTING QUALITY... POSITIVE CONTROL
... AND ECONOMY WITH YOUR KILNS? THIS KILN
DELIVERS ALL THREE AND IS ONE OF THE MANY
TYPES MANUFACTURED BY VULCAN

This one, 9'x300', is capable of delivering 225 tons of quick lime per day, and is operating efficiently for the United Cement Co. of Montevallo, Alabama.

This newest of kilns is mounted on VULCAN's latest type supporting rollers, all of which are automatically lubricated and easily adjusted to compensate for wear or moderate misalignment. It is driven by a 75 HP variable speed motor with a standby diesel-electric generator, in case of power failure.

This latest type Lime Kiln has a 60" disk feeder which is electrically synchronized with the rotating speed of the Kiln, which insures an even flow of raw material essential to quality control and economy. With the most modern gas flow and temperature reading instruments, positive control is constantly maintained over the burning operations.

VULCAN IRON WORKS designs, engineers and manufactures Kilns for: (1) Cement (wet or dry), (2) Dead Burning Dolomite, (3) Calcined Coke, (4) Lime, (5) nodulizing and agglomerating, (6) pigments. THE VULCAN IRON WORKS with its 107 years of continuous business means experience and know-how. Write today . . . Estimates, constructive suggestions and preliminary drawings will be furnished (as far as possible) without obligation.

Any information on items listed below will be sent to you immediately:

Rotary Kilns, Coolers and Dryers

Rotary Retorts, Calciners, Etc.

Improved Vertical Lime Kilns Automatic Quick-Lime Hydrators

Briquetting Equipment

Cast-Steel Sheaves and Gears

Steel Plate Fabrications

VULCAN IRON WORKS

WILKES-BARRE, PA., U.S.A.

"VULWORKS WILKESBARRE"

ESTABLISHED 1849

MARLO NOW AVAILABLE IN STAINLESS EQUIPMENT STEEL TO YOUR SPECIFICATIONS

HEATING and COOLING COILS



Stainless-Continuous plate type with staggered tubes and smooth drawn ferrules pressure-expanded to produce a highly effective positive mechanical and thermal bond between tube and fin. Also available with copper and aluminum tubes and fins in any combination.

. **EVAPORATIVE CONDENSERS**



Stainless-3-150 tons. Suitable for indoor or outdoor location. Quiet operating. All prime surface condensing coil.

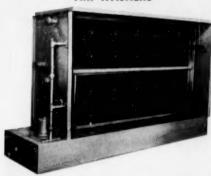
COOLING TOWERS



Stainless-2-150 tons. Suitable for indoor or outdoor location. Quiet operating.

AIR WASHERS

.



Stainless-Compact and sectional in construction, for quick, easy erection. Available in many standard sizes, also custom designed for special applications.

For More Complete Information, Send Coupon Attached to Your Letterhead.

MARLO

coil co.

SAINT LOUIS 10, MISSOURI

Quality Air Conditioning and Heat Transfer Equipment Since 1925

MARLO COIL COMPANY

6137 Manchester Ave., St. Louis 10, Mo.

Please send me complete information on the following stainless steel Marlo heat transfer equipment.

- ☐ Heating and Cooling Coils
- Cooling Towers
- Evaporative Condensers
- Air Washers

COMPANY_

ADDRESS_

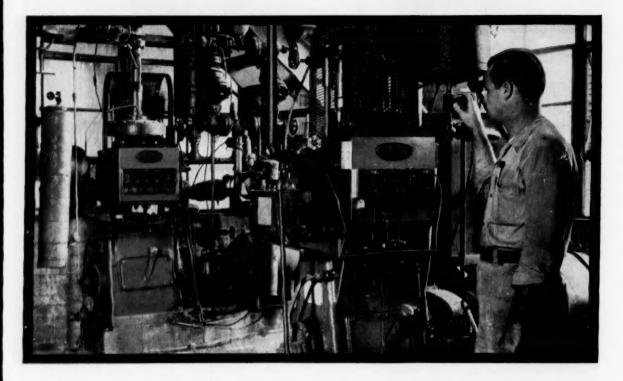
CITY

ZONE__STATE_

EMERY INDUSTRIES LICKS TOUGH PROBLEM:

How to pump fatty acids 24 hours a day, 7 days a week, and cut maintenance costs!

Around-the-clock hydrolysis produces fatty acids from animal fats, tallow, palm, soybean, cottonseed and corn oils at Emery Industries plant in Cincinnati, Ohio. Pumps work on hot corrosive fatty materials 24 hours a day, seven days a week, and maintenance used to be a costly problem. Packings had to be replaced far too often. Valves needed frequent refacing. Wear of plungers was excessive.



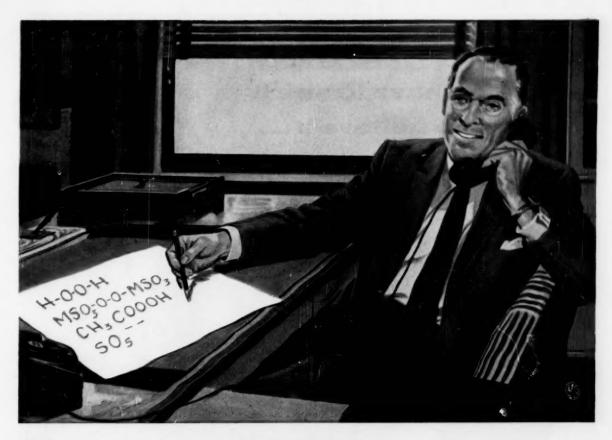
How Emery solved the puzzle: Looking for an answer to the problem of excessive downtime and maintenance, Emery conferred with several pump manufacturers. Aldrich was the only company to offer a pump better in both design and materials... the fluid end being of stainless steel. Original, ineffective pumps were immediately replaced with Aldrich Triplex Pumps.

Result: Two Aldrich Pumps have pumped

raw materials on a continuous basis since 1948. Two more were installed for additional capacity in 1954. Maintenance costs have been reduced substantially. Downtime has decreased to a minimum. Operating efficiency is now at an all-time high and quality of processing has improved. We'll be glad to send you full information on Aldrich Pumps and their advantages to you. Simply write Aldrich Pump Company, 3 Gordon Street, Allentown, Pa.

the toughest pumping problems go to





What can peroxygens— and BECCO—do for YOU?

If you are concerned with ...

Bleaching textiles or pulp, wood or leathers
Modification of carbohydrates
Dye oxidation
Foam rubber
Epoxidation and organic synthesis
Polymerization and depolymerization
Surface disinfection
Metal surface treatment
Color film processing
Powder bleaches and household detergents
Hair dyeing or cold waving
Dough conditioning

... you'll find Becco's thirty years of experience in the production and practical application of peroxygen chemicals can help you in many phases of your operation. No other company can offer you the benefit of this amount of exclusive experience — yours without obligation!

For example, just drop us a line, and an experienced Becco technical representative will call on you at your convenience, to discuss any process to which peroxygen chemicals are applicable. In addition, our staff of chemists and engineers is at your service to assist in any development work necessary. Finally, over 80 informative technical bulletins have been prepared and are yours for the asking — write us for the complete list. At the same time, ask to have our publication, BECCO ECHO; mailed to you regularly — it contains a wealth of information on peroxygen compounds. Address:

BECCO CHEMICAL DIVISION

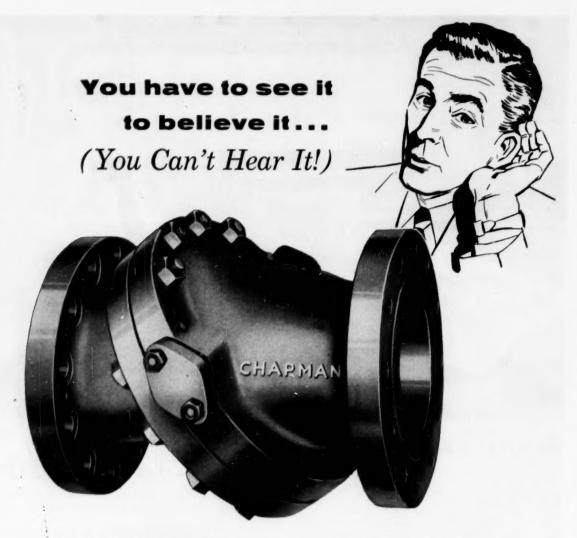
Food Machinery and Chemical Corporation Station B, Buffalo 7, New York

BUFFALO . BOSTON . CHARLOTTE, N.C. . CHICAGO NEW YORK . PHILADELPHIA . VANCOUVER, WASH.

Progress in Peroxygens BECCO



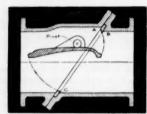
FMC CHEMICALS INCLUDE: BECCO Peroxygen Chemicals • WESTVACO Phosphates, Barlum and Magnesium Chemicals • WESTVACO Alkalis, Chlorinated Chemicals and Carbon Bisulfide • NIAGARA Insecticides, Fungicides and Industrial Sulphur • OHIO-APEX Plasticizers and Chemicals • FAIRFIELD Pesticide Compounds and Organic Chemicals



CHAPMAN Tilting Disc Check Valve

It's the silent valve. No noise, no vibration, no fluttering. On usual piping arrangements you get no slamming with a Chapman Tilting Disc Check Valve. You get no banging to cause damage to system or valve . . . no grinding, scraping or wearing of either the disc or seat. Your maintenance costs go down to an unbelievable low which is really something to see and enjoy.

You can safely use these valves under tough operating conditions. You can order them in iron and steel . . . for handling fluids or gases under a wide range of pressures. You can get them fast. See our Catalog 30-A. Write for your copy today.



Look at this operational chart. When the flow is on, "airfoil" disc is held firmly against stops in the body. When the flow drops, disc balances quietly on whatever flow there is. When flow stops, disc drops quickly, quietly and firmly on special bevel seat. Note that sufficient space is designed around disc to cut down flow resistance.

THE CHAPMAN VALVE MANUFACTURING CO.

INDIAN ORCHARD, MASSACHUSETTS

you can judge

comparative values of the book decion

It's quite simple



to obtain the full comparison of values

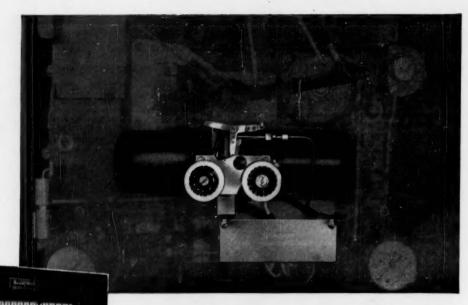
tions are applied to all the oppressing requirements, you can
the cure PETROCHEM ISOFLOW
PURNACES will be found ment
ocenemically desirable.
Its other furness design san
claim the recognition and acseptance achieved by PETROCHEM ISOFLOW FURNACES...
Liarting with one installation in 1940.
January '57 records more than 1960
ISOFLOW FURNACES in operation and
under construction—a record that is be-

er all these 9 specif

1—Average radiant transfer rate.

2—Maximum deviation from average radiant transfer rate. 3—Average and maximum transfer rate in convection section. 4—Maximum tube wall temperature, radiant or convection. 5—Maximum efficiency with specified excess air. 6—Controlled thermal recirculation of flue gases to provide even heat distribution throughout full length of each tube and equalized heat distribution around each tube. 7—Overload and corresponding transfer load. 8—Design to provide: structural column supports - Ladders - Platforms - Tube Removal facilities, etc. 9—Degree of assembly; of the furnace structure and of the heating surface.

PETROCHEM-ISOFLOW FURNACES



this instrument makes your tough control jobs easy

Electronik Air-O-Line controller measures with ±0.2% accuracy... provides fast, sensitive control

If your process can't stand any offset, if you insist on reliable performance and hairline accuracy . . . this is the controller for you. Sensitive to changes as small as 3 parts in 10,000, this controller holds the measured process variable right where it belongs.

The Electronik Air-O-Line controller measures and controls temperature, pressure, flow, pH -any variable that can be changed into an electrical signal. By standardizing on this controller for your most critical processes, you reduce your maintenance burden. The same components are used in both strip and circular chart models.

Maintenance? Hardly any with the ElectroniK Air-O-Line controller. Dirt, dust, and dampness are sealed out. Vibration won't affect operation. The three main components of the ElectroniK instrument-amplifier, converter, and balancing motor-can be easily replaced if necessary.

This controller has proved itself in thousands of tough applications. It's the product of pioneering experience in electronic instrumenta-tion . . . made by the world's largest instrument manufacturer . . . backed by the world's largest instrument service organization.

Call in your local Honeywell sales engineer for a discussion of your application. He's as near as your phone.

MINNEAPOLIS-HONEYWELL REGULATOR Co., Industrial Division, Wayne and Windrim Avenues, Philadelphia 44, Pa.—in Canada, Toronto 17, Ontario.

Electronik Air-O-Line FEATURES

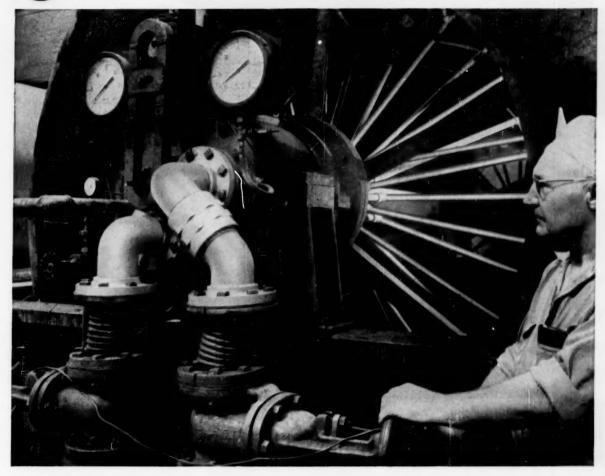
- Pneumatic proportional-plus-reset control
 Proportional band widths adjustable from 1 to over 200%
- matic reset rates from 0 to 14 repeats per minute
- Rate action unit easily added where needed factory-calibrated within limits of $\pm 0.2\%$ Hermetically sealed converter

- Totally enclosed balancing motor Sealed liquid-filled Air-O-Line unit with single, clog-free
- "Building block" construction for easy interchangeability



First in Controls





Pipeline of one of the Seven Wonders of American Engineering

Chicago's 403-million-dollar sewage disposal system every day processes 1200 million gallons of raw sewage. It's regarded by authorities as one of the seven engineering wonders of the nation.

Imagine the damaging effect on pipe of ferric chloride and other acidic chemicals used in the process! But this is not ordinary pipe in Chicago's great sewage disposal system. It is Uscolite® Plastic Pipe.

Uscolite Plastic Pipe was installed some eight years ago. Since then not a single leak has developed, not even a sign of weakness. The metal pipe it replaced had in some places been reduced to the thickness of a thumbnail!

The above rotary filter is but one of ninety-eight in the system. Each filter is 16 feet long, 11½ feet in diameter, contains 820 feet of 1" Uscolite Plastic Pipe and hundreds of Uscolite nozzles and additional fittings.

Uscolite Pipe and fittings are obtainable at our 28 District Sales Offices—each staffed with factory-trained engineers, at selected distributors, or write us at Rockefeller Center, New York 20, N.Y. In Canada, Dominion Rubber Co., Ltd.

NATIONAL SANITATION FOUNDATION SEAL OF APPROVAL AWARDED TO USCOLITE PIPE





Machanical Goods Division

United States Rubber



For some applications ONLY CHEMICAL CERAMICS will do

For only chemical ceramics will resist all acids, alkalies and all solvents (with the exceptions of hydrofluoric acid and hot caustics). White chemical porcelain, in particular, offers important processing advantages. In addition to its chemical inertness, white chemical porcelain is completely non-toxic and non-contaminating. Its smooth glazed surface makes cleaning a matter of minutes. It can be fabricated in one-piece construction into vessels of practically any shape and in sizes from a thimble to a thousand gallon tank. Many items of equipment, such as pipe, valves, fittings, sinks, filters and storage vessels are standard items carried in stock and ready for immediate shipment. Other items can be fabricated on short notice.

The United States Stoneware Company has been one of the world's principal producers of chemical ceramics for more than ninety years. Continual research and im-

proved manufacturing techniques give today's chemical ceramics characteristics far superior to those of even a few years ago: better heat-shock resistance, higher mechanical strength, closer dimensional tolerances.

Better take a fresh look at chemical ceramics. It may pay you well. Write today for Bulletin C-5.



499-1

Other Corrosion-Resistant materials manufactured and fabricated by U. S. Stoneware and its affiliated companies, include: TYGON Plastics, Duralon Resins, natural and synthetic rubber products, lead-lined equipment, adhesives and organic bonding agents, acid-brick and cements, and sintered metallic oxides.

Chemical Engineering

Developments

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JULY 1957

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Condulet Instrumer



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*Dust-ignition-proof.

In oil refineries, chemical plants, synthetic rubber plants — wherever constant watch of processing is necessary — Crouse-Hinds Condulet® Visularms provide visual indication of process conditions, and instant control of manufacturing equipment.

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Visularms are just one of hundreds of items in process control board equipment offered by Crouse-Hinds. Only a few are shown at left. For full information on the complete line, call your nearest Crouse-Hinds distributor, or write . . .



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Chementator

C. H. CHILTON

✓ Olin Mathieson's new cellophane plant at Olin, Ind., now reaching full production, uses a continuous process which Olin terms a "technological breakthrough." No details are available, but Olin has apparently achieved the long-sought industry goal of continuous viscose preparation.

- ✓ Fluid-bed chlorination of ethylene dichloride features Diamond Alkali's new perchlorethylene unit at Deer Park, Tex.. Outstanding, also, is purification column, one of the highest in Gulf Coast Area.
- ✓ Titanium producers may suffer a stiff blow if military and commercial aircraft swing over to GE's new Ti-less J-79 jet engine. GE claims J-79 outperforms other engines, such as Pratt & Whitney's J-75, which use appreciable amounts of titanium.

Low-cost ethylene from oil gas?

Could you use a steady supply of ethylene at a price of less than 2e/lb.? See your local gas company.

In many areas served by natural gas, the gas utilities maintain standby oil gas units which operate only a few days per year to take care of peak demands. Virgil Stark, president of North American Utility and Construction Corp., proposes that gas utilities put this idle investment to work on a year-round basis, adjusting operating conditions to maximize production of olefins and aromatics. In an economic study presented to the American Gas Association at its Miami meeting in May, Stark estimated that gas companies could produce ethylene for as little as 11/4 e/lb.

Stark's basic idea, which has been patented (U.S. 2,714,060), is to recover ethylene from oil gas by an appropriate combination of compression, refrigeration and absorption steps.

There is already a precedent for such an operation. Allied Chemical's production of polyethylene at Tonawanda, N. Y., is based on ethylene extracted from Semet-Solvay's oil gas production.

And Stark expects engineering and economic studies now under way for a large utility in New England to result in further application of his chemical recovery ideas to oil gas manufacture.

Detelescoping idea wins recognition

Boeing Airplane Co. has offered its engineers' union a new contract which contains a significant provision—recognition of the principle of salary detelescoping (Chementator, June 1957, pp. 139, 142).

The detelescoping offer, however, is disappointingly small. It would amount to only 2% on salaries over \$700/mo., with lesser adjustments on salaries between \$572 and \$700. It

(Continued on page 144)



THE OLIVER HORIZONTAL FILTER

A standard unit in a job-engineered application at

HOOKER ELECTROCHEMICAL

One of the most unusual and successful applications of the Oliver Horizontal Filter is at the Niagara Falls, N. Y. plant of Hooker Elec-

trochemical Company.

This installation is unusual due to the highly specialized nature of the Hooker Process. The unit handles the dewatering, multi-component solution washing and final dewatering steps prior to thermal drying of HET Acid,* an ingredient of Hooker's flame resistant polyester resin Hetron*. Basically constructed of stainless steel all direct contact components are coated with a non-contaminable, corrosion-resistant plastic. Product conditions require that the filter hood be of a liquid seal-vaportight design providing a completely closed air return system. Control is automatic and viewing ports with illumination are provided for

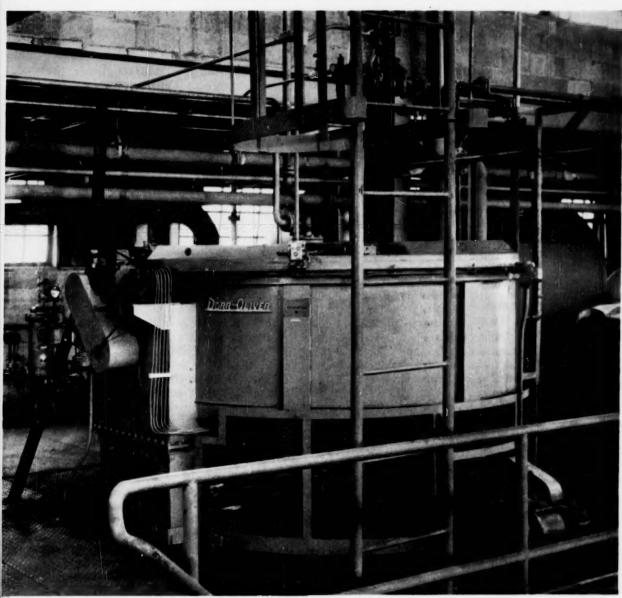
full visibility through the entire cycle.

The ability of the unit to provide sharp filtrate separations ideally suits the Oliver Horizontal Filter for solution washes when several filtrates must be kept separate. This feature along with many other facets of the versatility inherent in the Oliver Horizontal Filter, such as high capacity per unit area and multi-stage counter current wash, qualifies the standard unit for such highly specialized applications.

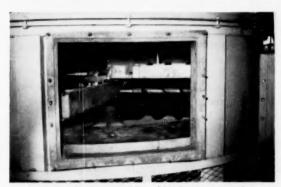
The Hooker Electrochemical installation is an excellent example of Dorr-Oliver ability to provide the equipment to fit the job. For further information on the Oliver Horizontal Filter, write to Dorr-Oliver Incorporated, Stamford, Conn. Ask for Bulletin No. 7201.

*T.M. Hooker Electrochemical Company

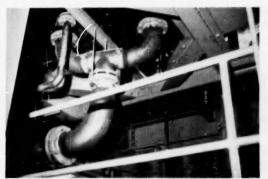




General view of Oliver Horizontal Filter station.



Access port showing accessibility of interior components, inner scroll support bearing not in place; note vapor-tight construction.



Underside of filter showing accessibility of integrally mounted valve and filtrate piping.

would be accompanied by a blanket 4% increase.

The union had argued that starting salaries at Boeing had increased 26% from 1954 to 1956. The 4% blanket increase in the present offer is supposed to represent the 1956-7 differential in starting salaries.

Growing markets boom silicon demand

Now there are four producers of hyperpure silicon. Texas Instruments and Eagle-Picher have just announced their entries into the field, joining established producers Du Pont and Sylvania.

Westinghouse and General Electric are working on silicon processes; both are producing limited quantities. Also known to be actively considering production are Monsanto, Merck and Foote Mineral.

Du Pont's production process is an improved version of the one it developed during World War II—reduction of silicon tetrachloride with zinc vapor.

Bell Telephone Laboratories, seeking to avoid trace impurities in zinc, substitutes more-easily-purified hydrogen as reducing agent in its production of silicon for its own research use. Other laboratories are known to be working with thermal decomposition of silicon tetrajodide.

What's behind this great show of interest in a product which carries a price tag, depending on quality, of \$100-980/lb.?

Semiconductor products which require hyperpure silicon are in for a surging expansion within the next five years. These products take the form of transistors, rectifiers, solar batteries and instrument components.

Stanford Research Institute predicts, for example, that transistor production in 1958 will be more than double the 26 million units expected to be made this year. And industry observers look for silicon to eventually outdistance germanium in many electronic applications.

Process seeks to upgrade coal waste

Latest—and most impressive—addition to Hydrocarbon Research's aggregation of pilot plants at Trenton, N. J., is a unit for making hydrogen by fluid-bed gasification of anthracite silt with steam and oxygen. The new unit, due to get its shakedown runs this summer, has a reactor 27 in. dia. by 60 ft. high.

Hoped-for payoff on this \$500,000 gamble is an economical process for upgrading a practically worthless waste material (valued at \$0.65 to \$2/ton in place) into an equivalent product value of \$18/ton (based on assumed hydrogen price of \$0.40/1,000 cu. ft.).

Putting up the ante is Philadelphia & Reading Corp., which has an accumulation of 30-40 million tons of anthrasilt from its eastern Pennsylvania anthracite operations over several decades. This supply of raw material could support a 50-million-cu.-ft./day hydrogen plant for 100 years.

Where would this hydrogen go? Ammonia and methanol are possibilities, of course. But P&R has its sights set on bigger game—the direct reduction of iron ore (Chem. Eng., Jan. 1957, pp. 130-134). It's no mere coincidence that another HRI pilot plant at Trenton is working on a Bethlehem Steel project for direct reduction with hydrogen.

Fluid-bed gasification is ideally suited to anthrasilt. Its high-melting-point ash, low volatiles and 25% inert content favor clean operation, without the formation of the messy gunk which often plagues soft-coal processes.

U-235 by centrifuging gets new trial

Separation of uranium isotopes by centrifuging—a process which never quite made the grade in our own atomic program—is getting serious attention in Germany.

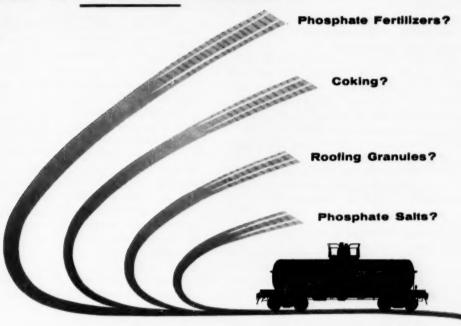
Investigators at Bonn University are about to begin tests on a battery of eight new centrifuges for separating U-235 hexafluoride from the U-238 isotope. These machines have a diameter of 7.2 in. and are 47 in. high. They will rotate at a peripheral speed of about 1,000 ft./sec. This figures out to be about 32,000 rpm., with a centrifugal force about 100,000 times that of gravity.

Earlier work on two machines of the same diameter but only 25 in. high achieved 2% enrichment. Since enrichment per stage depends on the ratio of height to diameter, the eight new machines—together with another one, 118 in. high, to be installed later this year—are expected to get a much greater degree of enrichment.

Big advantage of gas centrifuging, says Bonn's Prof. Wilhelm Groth, is that power costs will be only 10-12% of those of diffusion separation plants.

(Continued on page 146)

WHAT'S YOUR LINE?



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Centrifuging was considered a promising route to U-235 in the early days of the U.S. atomic bomb project. Standard Oil Development Co. built a pilot plant at Bayway and operated it successfully. No large-scale production plant was ever authorized because, according to the Smyth Report, of the magnitude of the engineering problems involved.

The Germans aren't underrating these engineering problems. One problem—lubrication—appears to be solved by the development of a new fluorinated lubricant, a product of Farbwerke Hoechst known as Hostaflon oil.

Furnace tube doubles as resistor

A promising new tool for chlorination of refractory oxides and silicates has now entered an advanced stage of development.

Salem-Brosius, Inc., Carnegie, Pa., has in operation an experimental 40-kw. resistance furnace which has successfully chlorinated ores of zirconium, chromium, columbium, tantalum and boron. Next on the list: molybdenum and titanium, the latter from Bayer-process red mud as well as from ilmenite.

Novel feature of the furnace is that the 7/g-in.-I.D., 24-ft.-long graphite tube forming the reactor doubles as the resistance element, producing temperatures up to 3,000 F.

Salem-Brosius, well-established in the metallurgical furnace business, won't go into the metal chlorides business, intends rather to license its chlorination know-how and to build chlorination furnaces.

Shale oil units seek missing link

If you're under 50 and live or travel in the western third of the U.S., chances are good that some day within your lifetime you'll be running your automobile on gasoline made from oil shale.

Even the skeptics are now willing to admit that we shall have a shale oil industry of major magnitude some day. The number one question is, when?

Eugene Ayres, recognized authority on the subject of energy resources, foresees shale oil production of more than a million bbl./day by 1975. W. C. Schroeder, formerly chief of Bureau of Mines' Office of Synthetic Fuels, estimates that the average capital cost for new and replacement crude petroleum capacity in the U.S., including exploration, production, refining and distribution, will increase from

about \$5,900 per bpd. for the period 1950-1955 to more than \$9,000 for the period 1960-1965, while capital requirements for a shale oil industry figure out to be only about \$8,000.

Number two shale oil question—which actually has to be answered first—is, how?

Help in answering this question may not be long in coming. Union Oil dedicated its large new experimental upflow retort at Grand Valley, Colo., on May 18, while some 150 miles farther east Denver Research Institute was starting up its new pilot plant to test the Aspeco horizontal-drum process (Chementator, Mar. 1956, p. 104, and Sept. 1956, p. 112).

Economical methods for mining shale and for refining crude shale oil have already been adequately demonstrated. Economical recovery of crude oil from the shale is the missing technological link which must be found before a competitive shale oil industry can thrive.

Salting-out recovers pulping chemicals

Western Precipitation Corp.'s novel process for recovery of soda-base sulfite liquor is getting its big chance. Consolidated Water Power & Paper Co. will build a \$500,000 experimental recovery unit at its Wisconsin Rapids, Wis., pulp mill.

Consolidated will study the process first on a 50-ton/day scale, will expand over the next two years to 200 tons. Unit will handle combined liquors from neutral sulfite and acid sulfite pulping operations. The acid sulfite mill, now on ammonia base, will be converted to soda base.

The WP process was put through pilot-plant paces in 1953-4 at Nekoosa-Edwards' Port Edwards (Wis.) mill. It differs from other soda recovery schemes (see *Chem. Eng.*, Feb. 1957, pp. 168-170) in the way it handles the sodium sulfide-carbonate smelt produced in the recovery furnace.

WP makes the smelt into the usual green liquor, but then puts the liquor through an evaporative crystallization step to salt out pure solid sodium carbonate. The remaining mother liquor recycles to react with the raw sulfite liquor, producing a liquor which can be handled in kraft-type evaporators and smelting furnace.

Thus all the sulfide in the smelt is converted directly to SO₂ in the furnace without the intermediate formation of hydrogen sulfide.

For more on DEVELOPMENTS. . 148

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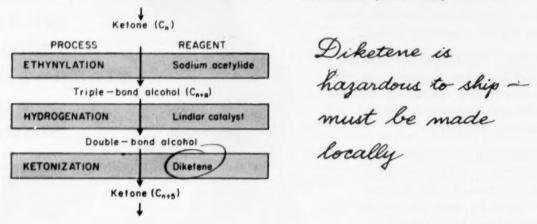
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4722

DEVELOPMENTS ...

PROCESSES & TECHNOLOGY C. H. CHILTON

How Simple Ketones Grow to Intermediates for Vitamins, Perfumes, Flavors



Addition Cycle Builds Synthetic Terpenes,

C HEMICAL synthesis is cracking another special stronghold of natural products this month as Hoffman-La Roche's \$5-million addition at Nutley, N. J., builds up momentum.

Roche has put into operation the first commercial process capable of building simple, abundant organic chemicals into terpenes. Terpenes and their oxygenated derivatives—like linalool, nerol, farnesol, geraniol, citral—are vital constituents of flavors and perfumes. Heretofore, they had to be derived from natural essential oils.

▶ Diketene Key — Engineering keystone of Roche's process is large-scale use of diketene as a chemical building block. Diketene has been little used in chemical processing before. Highly toxic, very sensitive, it's too hazardous to move in quantity through usual channels of commercial transport.

Roche, therefore, has put in its own unit for making diketene via cracking of acetone to ketene and dimerization of the latter. This continuous unit—probably the biggest diketene plant in operation anywhere—represents a 50-to-1 scale-up of pilot-plant.

One of the tricks in diketene synthesis is to separate ketene from its decomposition products, ethylene and carbon monoxide. Roche absorbs ketene in recycled dimer (a liquid under ordinary conditions), puts the mixture through the dimerization reactor.

Any unreacted ketene (1-2%) flashes off and is absorbed in alkali. Hot ketene-free gas (mostly methane) goes to fire the acetone cracking furnace (ketene dimerization is strongly exothermic). Diketene product is continuously fractionated at 200 mm. Hg and about 85 C.

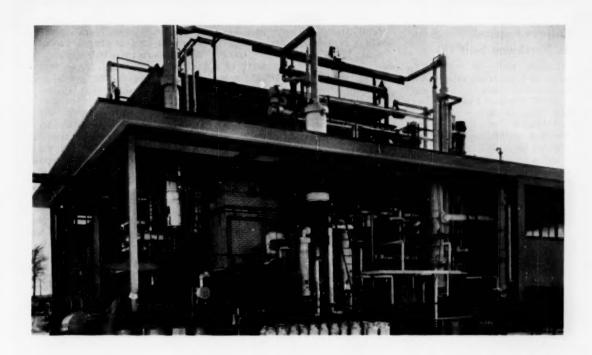
▶ Repeating Cycle — Successful production of diketene permits Roche to bypass the classical—and prohibitively expensive—reagents in terpene chemistry, like acetoacetic esters, sodium methylate and hydrobromic acid.

The entire synthesis involves repetition of a three-step sequence: Ethynylation of a ketone to a tertiary alcohol; hydrogenation of the alcohol's triple bond to a double bond; and condensation with diketene to form a methyl ketone.

Two cycles of this sequence pyramid acetone past the terpene-carbon level to pseudoionone (C₁₃), gateway to vitamins A and E, beta-ionone, beta-carotene and a host of other carotenoids.* Up to now, pseudoionone has been derived from the citral in lemongrass oil.

► Engineering Know-How — To set up two-thirds of this processing cycle—low-pressure ethynylation and selective hydrogenation—Roche's development team drew in large part upon the company's unique experience with acetylene and Lindlar catalyst in its vitamin A synthesis. Engineers added plenty of know-how on their own, including:

^{*}Roche feels its basic technique is applicable in principle to any ketone or aldehyde. It can lengthen side chains, shift double bonds around, insert new substituents. Hundreds of new compounds are already being evaluated for use in vitamin and perfume fields.



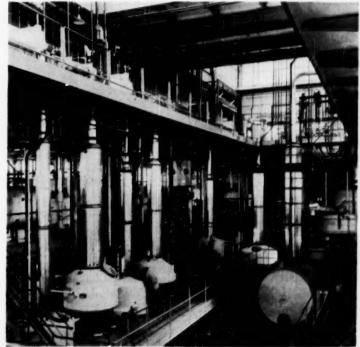
Diketene Unit Makes New Process Possible

• Functional design for complete integration of basic chemical schemes with equipment and buildings. Fine-chemical producers traditionally put up a building, arrange equipment in available space and pipe it according to a flowsheet.

• A three-story building, perched on a hillside, in which the all-fluid ethynylation step goes on with nary a pump.

► Commercial Promise — Marketwise, Hoffman-La Roche is in a pretty sweet spot. Most terpene chemicals sell in the \$5-10/lb. range, ring up annual sales of some \$100 million. Most makers and buyers of these chemicals—the perfume and flavor houses—are located in the Metropolitan New York-New Jersey area.

And should supplies of, say, lemongrass and rosewood oils get really tight for one reason or another, Roche's total synthesis assures economical supplies of carotene and vitamins A and E which were once so dependent upon these natural sources.



DISTILLATION UNITS purify new synthetic terpene chemicals.

Pulpers Expand, Move In As Northwest Sees Boom

Latest rash of new pulp mills and expansions sprinkles Canada and Alaska.

North Western Pulp & Power, Ltd., has started up its mod-\$42-million, 430-ton/day bleached sulfate pulp mill at Hinton, Alberta. The Hinton mill is the largest installation of continuous Kamyr digesters, boasting close control of variables in the cooking process. Six-stage bleach plant provides two-stage chlorine dioxide bleaching to get uniform white pulp. Pulp dryer begins its operation with a slush pulp of about 99% water, reduces it to 95-100% fiber.

Japanese-owned Alaska Lumber & Pulp Co. plans to build a \$55-million pulp mill near Sitka, Alaska. Firm hopes to ship to Japan 120,000 tons/yr. of pulp, beginning in 1959 or 1960. Pulp will be used by Japan's rayon manufacturers.

Capacity of Columbia Cellulose Co.'s dissolving-pulp mill at Prince Rupert will be boosted over the next few years as a result of installing a new \$1-million digester. Columbia President M. W. MacKenzie said digester would up capacity by about 10%. MacKenzie did not elaborate on plans for a projected pulp mill in the Castlegar area but confirmed that preliminary engineering studies had been completed.

Three More Firms Swell Southwest Chemical Boom

Chemical expansion, nowhere leapfrogging so impressively as in the Southwest, is getting a healthy boost from three new projects in the Houston, Tex., area.

Rohm & Haas Co. is sinking \$40 million into new units at its Deer Park plant on the Houston Ship Channel. Under a veil of secrecy, Rohm & Haas has been rushing ahead with plants for acetylene (\$10 million), ammonia and methanol (\$20 million), ammonium sulfate, monoethanolamine and other chemicals. New acetylene plant should be finished this month; probable end use for acetylene

is acrylic esters. Work on the ammonia and methanol facilities is more than half-done.

Diamond Alkali has just doubled capacity of perchlorethylene, anhydrous hydrochloric acid and polyvinyl chloride units at Deer Park.

United Rubber & Chemical Co. has drafted plans for a \$650,000 modernizing program at its 44,000-ton/yr. Baytown synthetic rubber plant. Program includes new buildings, process piping, power and electrical facilities.

Household Detergents to Wash Away Roentgens?

If you're exposed to low-level radioactivity, best way to wash it off is with a household detergent or the waterless hand creams used by mechanics.

That's what W. J. Friedman, health physicist at the Navy's radiological defense laboratory in San Francisco, told delegates to the recent National Industrial Health Conference in St. Louis.

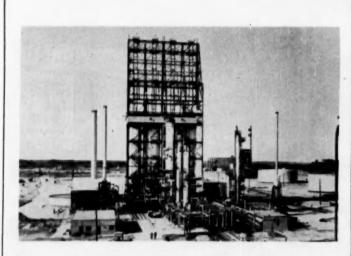
He said that tests on volunteers showed that these two agents were most effective in decontaminating skin exposed to dry particulate radioactive contaminants. Other methods, including soaps, creams and scrubbing agents, were tried on volunteers exposed to 10,000-50,000 counts per min. of radioactivity. This is an exposure that might be faced by plant or laboratory employees working with radioactive substances.

First Surfactant From Sugar Is Dipalmitate

First sugar-derived surfaceactive agent to be introduced to industry is being produced at Berkeley Chemical Corp.'s pilot plant at Berkeley Heights, N. J.

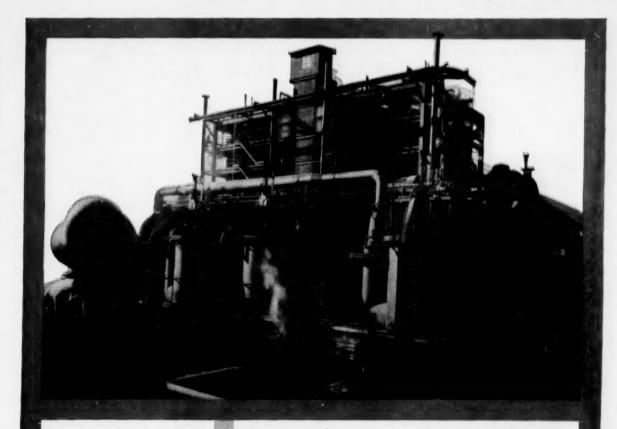
Marketed as Sucrodet D-600, it is a recrystallized sucrose dipalmitate, developed primarily for use in the food, pharmaceutical and cosmetic industries.

Within a few months, Berkeley plans to follow Sucrodet D-600 with sucrose esters derived from stearic, oleic, myristic and lauric acids.



Delayed Coker Design Handles Heavy Charge

Lummus-designed delayed coker, now operating at Amoco's Yorktown, Va., refinery, makes 603 tons/day of coke, handles heaviest feed ever charged to such units (API gravity: 6.1°; SFS viscosity: 6,000 at 210 F.). Design insures even heating.



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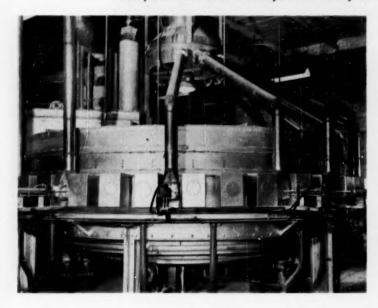
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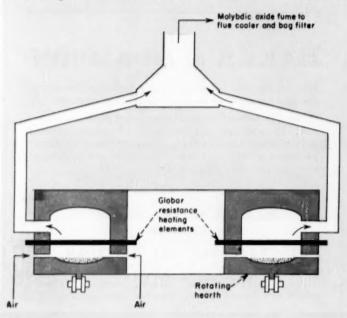


Electric Furnace Sublimes Pure Oxide

Climax Molybdenum starts up its second unit to turn out high-purity molybdenum oxide. Molybdena catalysts take sizable chunk of output.



Rotating Hearth Features Novel Sublimation Furnace



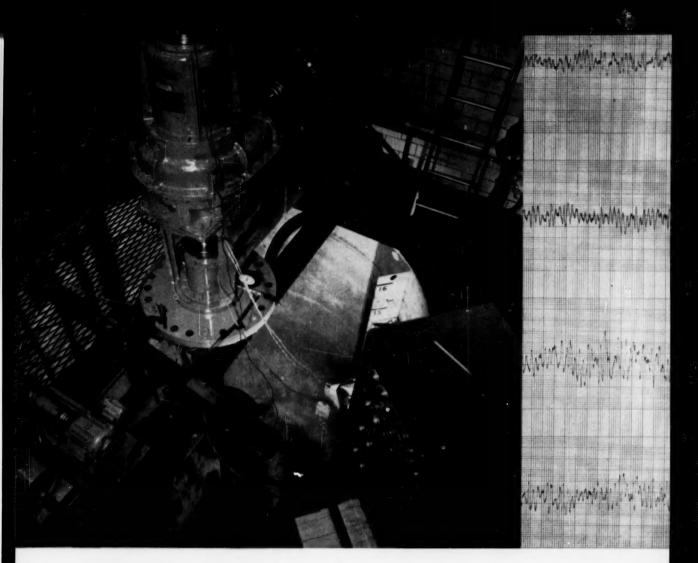
Urged by rapidly growing demands, Climax Molybdenum Co. has more than doubled its production of high-purity molybdic oxide at Langeloth, Pa. And encouraged by the success of earlier process pioneering, it has renominated the relatively unfamiliar unit operation of sublimation to handle the job.

Early this year Climax fired up a second—and markedly revamped-electrically heated sublimation furnace to upgrade technical-grade oxide. Reaching full heat in April, the new \$600,-000 installation now turns out over 3 million lb./yr. of oxide running 99.5% or more MoOs. Rust Engineering served as contractor; Carborundum Co. and Engineering with Climax on furnace design. ► Heavy and Fine — With its No. 1 sublimation unit (1942) able to deliver some 2.7 million lb./yr., Climax now rates far and away as the largest producer of high-purity molybdic "While many people consider this kind of purity in the fine chemicals class," points out a company spokesman, "we've geared for tonnage production. Because, after all, that's what the market's demanding."

Backing his view: Sales of pure oxide have steadily climbed 20% per year for the past five years, from 1.5 million lb. in 1952 to 1956's 3 million lb.

Molybdenum-based catalysts rate as the largest and fastest-growing single market, taking 850,000 lb. in 1956 as compared with 100,000 lb. in 1952. Sintered and arc-melted moly metal, especially as strip and wire for electronic tubes, electrical contacts and lamps, count as another expanding outlet. And for making so-called superalloys with high corrosion and heat resistance, pure oxide is strongly on the upsurge.

▶ Process Basis — Key to Climax' process is the fact that molybdic oxide starts volatilizing around 1,100 F., some 300 F.



How this shaft deflection test can give you better fluid mixing

Some secrets of efficient fluid mixing lie hidden beneath the tug-and-pull of fluids buffeting this LIGHTNIN Mixer's impeller.

These fluid forces are beginning to yield clues that can help you get improved mixer design and lower mixing costs.

Solving the seal dilemma

For example, if you're mixing fluids under pressure or vacuum, you probably want the great operating economy of a rotary mechanical seal.

You want the shaft diameter large enough to run with minimum deflection, to keep the sealing faces accurately aligned—but not larger than really necessary.

Seeing what deflection looks like

That is one reason why, as the 4-inch shaft on this 50-horsepower LIGHT-NIN test unit revs up toward its natural vibration frequency, four MIXCO-designed strain-gage pickups start "taking the pulse" of the rotating shaft.

At the recorder, four electric styli trace a profile of the frequency and amplitude of shaft deflection during the run, in various liquid depths, and under different conditions of impeller size, location, and tank baffling. The data are accurate to 0.0005 in.

Combined with continuous torque measurements, this composite profile provides basic data for computing the stresses acting in the shaft.

Getting rid of a bearing

Efficient mixer shaft sealing is only one product of these test runs. They also permit highly accurate design of overhung shafts to operate without a steady bearing in the tank bottom, thus eliminating a major maintenance cost item.

This is one of the new directions MIXCO research is taking. Our research department welcomes the opportunity to cooperate with you in any phase of your work leading to more efficient fluid mixing.

*Lightnin Mixers...

MIXCO fluid mixing specialists

MIXING EQUIPMENT Co., Inc., 128-g Mt. Read Blvd., Rochester 11, N.Y. In Canada: Greey Mixing Equipment, Ltd., 100 Miranda Ave., Toronto 10, Ont.



U-TUBE coolers drop temperature of hot gas, protect baghouse.

below its melting point. And keys to the furnace itself are Carborundum's Globar silicon carbide electrical heating elements.

Technical-grade oxide (90% MoO₅) is spread thinly on a doughnut-shaped hearth that rotates slowly under the hot Globars. As pure oxide sublimes, an air stream drawn over the hearth sweeps oxide fume out of the furnace to be cooled, collected and densified.

► Engineering Revamp — Operating principles, over-all design and dimensions of both furnaces are pretty much the same. But Climax engineers, turning to good advantage their experience with the first, have made these significant improvements:

• Globar heating elements have been increased in diameter from 1% in. to 2% in.; number of elements has been increased from 29 to 32. These changes allow each element to operate at lower surface temperatures for longer life while still delivering the same amount of heat to the hearth.

· Primary transformer ca-

pacity has been boosted from two 350-kva. units to three 500kva. units. This gets increased furnace output without increased furnace size.

• A bank of eight 110-kva. tap transformers has been added to the electrical circuit. This means that only four Globars are hooked to a single transformer (instead of the 14 and 15 of the older unit) to provide improved electrical efficiency.

 Handling of feed and product have been converted from partly manual to completely mechanical operations.

• A U-tube cooler has been inserted between furnace and baghouse to reduce temperature and volume of oxide-laden gases. And all equipment in contact with pure oxide is fabricated of either aluminum or stainless steel to insure product purity.

Furnace Design — The sandfilled hearth, 11 ft. 3 in. pitch dia. and 5 ft. 4 in. wide, is enclosed in a steel shell. About 18 in. above the hearth is the roof of a 46-in.-wide, concentric arch constructed of layers of refractory and insulating materials. Arch walls are about 14 in. thick. A 50-deg. segment of the hearth shell, closed by refractory-lined steel doors, provides a loading and discharging zone. Hearth rotates through the steel tunnel at 2 rev./hr.

The 32 Globars, located horizontally some 8 in. above the hearth, fan out about 10-deg. apart through the arch walls. Each Globar is 81 in. long by 2½ in. dia., with 48 in. of its length representing actual resistance-heating surface. Each of the eight 110-kva. transformers can apply a voltage to the Globars ranging from about 105 to 310 v. in steps of about 6 v. each.

Air enters through the gap between the hearth and furnace walls. At about the same height as the Globars, along the outer furnace wall, are twelve 5-in.dia, gas exhaust ports,

► Feeding Furnace—Technicalgrade molybdic oxide, produced in molybdenite (MoS₂) roasting furnaces at Langeloth, comes from storage bins via three vibratory feeders. A weigh-belt feeder meters charging rate, and a bucket elevator at the end of the line lifts the oxide to a 10cu. ft. steel hopper over the furnace's loading zone.

At this point two 5-in.-dia. steel ducts carry any dust from feeding operation to a secondary dust collector, a two-compartment, wool-filter baghouse. Another 5-in.-dia. duct returns the material to the hearth.

➤ Sublimation—A thin layer of oxide is spread on the sand surface of the slowly rotating hearth. Air, drawn by a 75-hp., 25,000-cfm. exhaust fan, sweeps over the hearth surface. And the Globars, operating at about 2,300 F., provide a hearth temperature of 1,850-2,150F. Sand hearth absorbs a great deal of molten oxide and rapidly becomes saturated.

Feed travels only one revolution. At the end of the ride the hearth passes under a tailings screw that withdraws residual impurities from hearth surface. These materials, which still contain up to 50% MoO₅, are returned to a molybdenum recovery circuit.

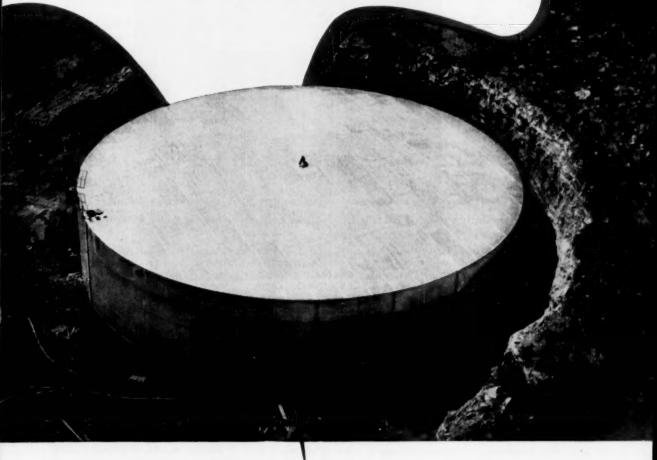
Air, at about 300 lb./min., sweeps pure oxide fume to the exhaust ports. Stainless steel, 5-in.-dia. riser pipes conduct the gas streams to a stainless steel distributor box which, in turn, feeds the cooler.

► Cooling, Collecting, Densifying-A U-tube cooler drops the temperature of the gas stream to about 300 F. Six stainless steel U-tubes, 30 ft. high by 3 ft. dia. with 1-in.-thick walls, are banded together and mounted vertically. Located out of doors, the unit is cooled by natural air circulation. Gases can be cooled to below 200 F., if necessary for baghouse protection, by admitting filtered air to the tubes. Pure oxide from cooler is collected in a 10-compartment, wool-filter baghouse having a capacity of 10,-000 lb./day of oxide.

Because of its low density—13 lb./cu. ft.—oxide from the baghouse is pugged with a small amount of deionized water to ease handling and reduce bulk. This is done in a twin-shaft mixer fabricated of stainless steel. Final density is about 90 lb./cu. ft. Then a radiant-heat, vibrating-pan dryer dries oxide

before packaging.

2,333,333-gallon
CB&I-Built Aluminum Tank...



stores 83% ammonium nitrate

It's the world's largest all-aluminum tank. 120 ft. in diam. by 26 ft. high and constructed of more than 300,000 lbs. of Alcoa aluminum, it was fabricated and erected by Chicago Bridge & Iron Company for the Mississippi River Chemical Company at Selma, Missouri. Providing storage for 2½ million gallons of 83% ammonium nitrate, it provides Mississippi River Chemical Company uninterrupted storage

service with a minimum of maintenance.

Chicago Bridge & Iron Company has complete facilities at four plants to design, fabricate and erect special and standard plate structures of steel or other special metals to meet your most rigid specifications.

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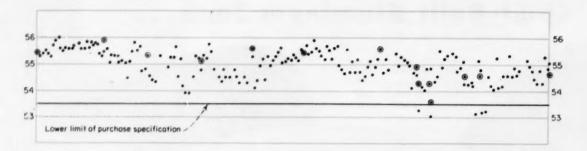
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Spot-Checking Cuts Control Lab Costs

Chart shows how Owens-Corning maintained quality control over 200 incoming cars of calcined trona last year while actually checking only 20.

By spot-checking occasional carload shipments of raw materials for its Kansas City, Kan., glass-fiber insulation plant instead of analyzing each carload, Owens-Corning Fiberglas Corp. is saving an estimated \$10,000/yr. in control laboratory costs.

Under the old system of checking every shipment of raw material received from its vendors, OCF had four men—one supervisor and three technicians—operating the laboratory. Now, to spot-check an average of one car in ten, only one of the three technicians is needed.

Since the Kansas City plant no longer duplicates the inspection job already done by the vendors, OCF's spot-checking yields a tidy savings in time and precious manpower.

OCF has operated the system successfully on calcined trona for the past two years. During that time, its use has gradually broadened to the point where OCF now spot-checks nearly all the plant's incoming raw materials, including dolomite, Kaw River sand, limestone, arsorite, asphalt, spray oil, powdered phenolic resin and acoustical paint.

Set Up—First step in setting up a spot-check system, according to Gerald Mahnken, control lab supervisor for OCF, is to note purchase specifications on a chart.

For its needs, OCF decided

that calcined trona—critical material in the manufacture of glass—should contain a minimum of 53.5% Na₂O. Though the process control laboratory does a complete chemical and sieve analysis, this chart considers only the one important specification. (Note that there is no upper limit specification.)

Next OCF decided that analysis of about one carload in ten should be adequate to:

Make sure that purchase specifications are fulfilled.

• Determine the Na₂O content of the glass batch composition in order to maintain constant operating viscosity.

• Establish the fundamental properties of trona for future reference and an average value for use in calculating the theoretical glass composition.

► Random Check—The one in ten are inspected on a random basis. The vendor can't anticipate a spot-check as long as a rigid schedule is avoided.

For comparison, the vendor's reports (solid dots) are charted along with those of the spot checks (circled dots). Though some of the trona has on occasion been below specification no serious trouble has resulted. Specifications have a built-in safety factor. What's more, the true Na₂O content is probably between the vendor's and OCF's figures due to inevitable differences in lab reports.

The chart above records 200

shipments of calcined trona received from a single vendor during 1956. Each dot represents approximately 50 tons.

Success Factor—Mahnken is quick to point out that the actual success or failure of the system hinges on what kind of climate exists between the customer and the vendor. It works only in a healthy climate of mutual trust and respect. Should the customer have reason to belive that a supplier is trying to cheat him, he'd have to return to the old method of checking everything and, obviously, the whole system would fall apart.

► For the Future — Mahnken isn't surprised at management's resistance (even at other OCF units) toward the use of spotchecking. Here are some of the reasons:

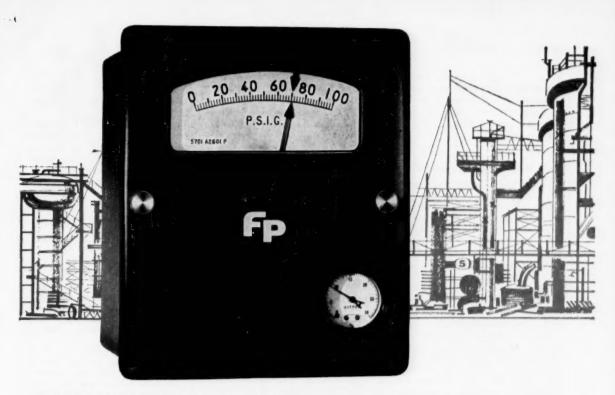
• There's a natural fear of the untried; why take a chance on a new system when you've already got one that works?

 Once a lab has been built up, it's no easy job to find someone willing to take a cut.

 There is a reluctance to spot-check where expensive and critical raw materials are involved.

Very often the critical value of a material is overestimated, Mahnken asserts. In other instances its value may decrease but the same rigid inspection continues unchanged.

If and when spot-checking is



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NOW...instruments as corrosion-resistant as the equipment they control! Every instrument in Fischer & Porter's new 1450 Series is housed in a fiber glass reinforced polyester case resistant to acids, alkalis, salts, solvents, dust, and weather. You can place indicators, transmitters, and controllers wherever you want—inside or out—without regard for corrosive fume and splash. The protection is built right into the housing...nothing to wear away or scratch off...no coatings to renew. The first such equipment available for process instrumentation, Series 1450 brings a new flexibility and freedom to instrument installation.

There's no way for corrosive atmospheres to reach the working instrument. Every exposed part is either plastic or 316 stainless steel. And a polyvinyl chloride gasket provides a positive seal against dust and moisture entry.

F&P has engineered the unique new 1450 Series housing for operation and maintenance ease. The entire instrument can be removed from the case if desired. Zero adjustment and range changes are easy. A plug in the removable door provides access to the adjustment screw for the optional external set point.

Field tested over a one year period, the 1450 Series is available NOW on four week delivery schedules.

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Instrument Options:

Single indicator • dual indicators • single indicator with dual alarms • indicating controller with any mode of control • indicating transmitter. Transmitter can provide pneumatic outputs, resistance outputs, or differential transformer outputs.

Controller Options:

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widely adopted, though, Mahnken predicts great savings on a national scale in terms of fewer manpower hours wasted and lower-priced products for the consumer.

New Waste-Acid Treatment Shows Pilot-Unit Promise

Optimistic progress reports on the steel-industry-financed experimental unit now piloting the Blaw-Knox-Ruthner process (Chem. Eng., Feb. 1956, p. 132) foreshadow a solution for one of the most complex pollution problems in the Ohio Valley: Pickle liquor discharging into streams and rivers at the rate of 600 million gal./yr.

Results from six months' operation of the \$500,000 acidrecovery pilot plant at Republic Steel Corp.'s Niles, Ohio, site hint that the process may be headed for commercial scale-up in the not-too-distant future. Test run has been chiefly concerned with search for suitable materials to handle the corrosive liquor. All corrosion problems met so far have been licked. However, pilot unit is slated to run for a few more months before process can be evaluated completely.

Electro-Process Promises Hard Coatings for Steels

Laboratory studies under way at University of Washington are throwing light on a new fused-salt process for electrolytic production of titanium boride, borides of zirconium, chromium, thorium, and silicides of titanium, zirconium and molybdenum (Chem. Eng., Nov. 1956, p. 103).

Process, developed by R. W. Moulton, is significant because it permits exceedingly hard coatings to be applied to steel. Cell consists of graphite crucible and suspended steel cathode, deposits 5-10 gm./hr. of product. Now, Moulton says, he can specify size of equipment needed for pilot-plant operation.

Moulton has reached current efficiencies as high as 65%, finds efficiency is dependent on fusedsalt temperature (with maximum value at about 720 C.) and on the composition of the melt.

After pilot studies are completed, process will be scaled up 10-20 times again (after a 10-20-time scale-up from lab studies) before building a commercial plant.

Deposition of boride occurs through combination of two cathode reactions: Electrolytic reduction of titanium ion formed from fluotitanate ion; and chemical reduction of fluoborate ion by metallic potassium deposited at the cathode. Titanium and boron react to give diboride.

New Uranium Process Wins High-Purity Metal, Oxide

Kitchen chemistry has paid off in a long-sought process (now being primed for commercial use) for extracting uranium from ore by electrolysis.

Process performance, according to tests carried out in Albuquerque, N. M., is reported to be far better than that of existing commercial methods, claiming 95% extraction of available uranium in the ore and an oxide cake of 90% purity.

Although other researchers have tried and failed with elusive electrolysis, Los Alamos chemist Theodore Crawford, backed by Yucca Mining & Petroleum Co., reverted to the days of alchemy and unkinked the knotty route using steel bowls in his kitchen.

Crawford passes current through a boiling water slurry of crushed ore, depositing uranium metal on steel plates. (Boiling solution forces out troublesome gas, allowing uranium to plate out on electrode.) Then plates are cleansed by a brief dip in nitric acid solution which oxidizes the metal to U_2O_3 . Acid solution is evaporated, leaving yellow oxide.

► Economics Are Attractive— This high-yield, high-purity process, according to backers, could cut mill construction and operating costs in half.

Last year Crawford and two Los Alamos associates formed Electro Winning Corp. to develop the process commercially. And already Yucca Mining & Petroleum has supplied \$35,000 to help develop the process and as part payment to use process in a series of mills which both firms will license jointly, sharing profits.

Yucca President Melvin Richards admits some engineering problems must still be solved. But, he added, the two firms should be able within about seven months to offer licenses on the process.

Convention Calendar

Industrial Statistics for the Process Industries, summer course, School of Chemical Engineering, University of Oklahoma, Norman, Okla., July 8-19.

Summer Session in Gas Technology; natural gas transmission, natural gas fuel utilization, Institute of Gas Technology, Technology Center, Chicago, July 8-26.

British Plastics Federation, 4th exhibition and convention, Olympia, London, England, July 10-20.

Joint Conference on Thermodynamic and Transport Properties of Fluids; Institution of Mechanical Engineers and International Union of Pure and Applied Chemistry, London, England, July 10-12.

Process Control Theory, Case Institute of Technology, Cleveland, Ohio, July 15-Aug. 2.

First National Conference on Applied Heat Transfer, Pennsylvania State University, Aug. 11-15.

Sixth National Clay Conference, including field trip to major clay deposits, University of California, Berkeley, Calif., Aug. 19-23.

Conference on Liquid Scintillation Counting, Technological Institute, Evanston, Ill., sponsored by Northwestern University, Aug. 20-22.

1957 Gas Dynamics Symposium, Technological Institute, Evanston, Ill., Aug. 26-28.



new ways to solve problems - with chemicals

NEW HEAVY-DUTY LIQUID DETERGENT FORMULAE --- mixtures of triethanolamine, nonionic surfactants and carboxymethyl cellulose --- have shown better cotton detergency under test than the more usual phosphate-alkylaryl sulfonate liquid mixtures, and have exhibited a washing action equal to that of heavy-duty powders.

Liquids have these advantages over powders:
(1) no dust; (2) can be packaged in metal or glass containers which do not become soggy;

dissolve readily in hot or cold water;

(4) take up less space because of high density.

- A RECENTLY DEVELOPED INSECT REPELLENT designed specifically to shoo horn flies away from cattle, is reported to contain an ethylene oxide-orthocyclohexyl phenol condensation product as the active ingredient.
- A DEVICE FOR MINE BLASTING employs nitrogen tetroxide and a hydrocarbon as the explosive mixture. It consists of an unpartitioned container holding frozen nitrogen tetroxide, a separate body of frozen hydrocarbon and a detonator.

A hole is bored in the solid composite and the device is placed inside. The contents of the container are melted, tetroxide mixes with hydrocarbon, and the detonator explodes the mix.

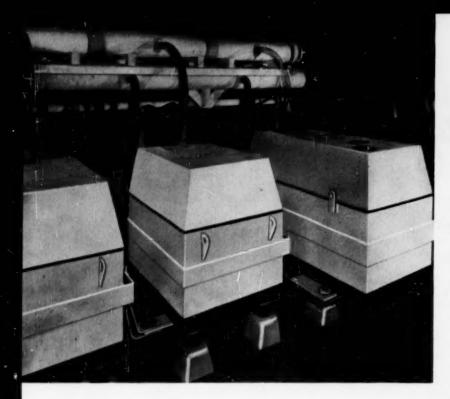
NEW HYDRAULIC FLUIDS take advantage of the stability, solvent properties and desirable temperature characteristics of ethylene glycol.

Formulations include: a magnetic fluid composed of 60-90% iron particles and 10-40% of a liquid hydrocarbon containing up to 5% ethylene glycol; a transmission fluid for automobiles consisting of 50% water and 50% ethylene glycol plus additive traces; a hydraulic pressuretransmitting fluid made up of 5-30% of a polyethylene glycol lubricant, 5-30% of a liquid soap and 40-90% of ethylene glycol solvent.

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Bigger Cell → Lower Costs

Chlorine makers now have another crack at soaring construction and operating costs as Diamond puts its new 30,000-amp, diaphragm cell up for licensing.

Stepping its diaphragm-type electrolytic chlorine cell up to the big 30,000-amp. class, Diamond Alkali Co. has developed a feature-packed unit that's now won an impressive vote of commerical confidence from an unbiased industry veteran.

Wyandotte Chemicals Co. has named the new cell, under a license arrangement, to its upcoming Baton Rouge, La., chlorine-caustic plant, slated on stream late next year. And Diamond predicts that the cell will attract further industry attention.

A company spokesman points out reasons for this optimism. The cell offers low investment, maintenance and operating costs, coupled with flexibility in production rates, high operating efficiencies and product qualities.

To back up its claims, Diamond can point to its own operating experience with the cell. Hooked on stream late last fall at Diamond's Deer

Park (Tex.) facility, two big cells are each delivering some $1.1 \, tons/day$ of Cl_z and $1.2 \, tons/day$ of NaOH. And, enthusiastic with results, Diamond plans to install additional 30,000-amp. cells in the near future.

b Magnified Attractions—Lured by the persuasive economics of big diaphragm cells,* Diamond has modified its 20,000-amp. unit—a direct descendant of the pioneer Tucker-Windecker cell—that forms the heart of the present Deer Park operation. In enlarging it to 30,000 amp., Diamond succeeded in magnifying its already highly regarded features.

Production rate flexibility
 Cell's assigned rating of 30,000 amp. has actually proved to be a minimum. Diamond has successfully run the unit at 34,000 amp. and, as a Deer Park engineer puts it, "We're still not cer-

* Hooker showed the way with its Type S3-B 30,000-amp. cell. See Chem. Eng., Apr. 1956, p. 110. tain how high we really can go." Diamond estimates that the maximum limit is around 36,000 amp. without significantly sacrificing current efficiency (around 96.5%) or product quality.

• Low investment cost— Cell's all-metal base, rather than the usual concrete, means reduced weight and floor-space requirements. And feed-brine and cell-liquor streams are broken positively outside the cell to permit compact arrangement of piping.

Based on operation at 33,000 amp., an installation designed around the new cell needs an over-all floor space—including cell repair room—of 110 sq. ft./ton Cl₂. This compares to the 20,000-amp. cell's 170 sq. ft./ton.

• Low maintenance and operating costs — Ruggedly constructed, the cell promises trouble-free performance. When it is necessary to repair or recondition a cell, its design permits the entire assembly to be removed from the circuit and replaced with a unit already fit for action. This minimizes downtime and allows the use of massproduction techniques in replacing diaphragms and anodes.

And two rows of cells can be run from a single operating assle. This means that there's no conflict between cell replacement and normal operations. Diamond places its cell repair labor at about 0.2 man-hr./ton Cl₂ as compared with the 20,000-amp. cell's 0.3 man-hr./ton. Cell needs about 2,800 kwh./ton Cl₃, consumes 7.5 lb. graphite/ton for an average anode life of 220 days and has a diaphragm life of 110 days.

▶ New Dimensions—Cell, rectangular in shape, is longer and higher than its 20,000-amp. cousin (see photo). But its width is the same. Concrete cell head is bolted to the all-metal base.

Steel screen-tube cathodes, covered with deposited asbestos-fiber diaphragms, are fabricated as an integral part of the cell walls. Graphite anodes, fitted between the cathodes, are held in an upright position by cell base assembly.

Brine feeds to the cell through the head, and chlorine is recov-

Here's why you get

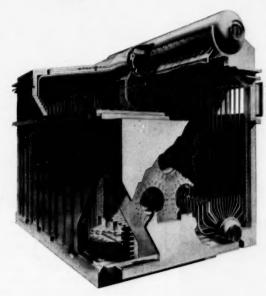
IMPORTANT SAVINGS in

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- ✓ installation
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THESE nine Foster Wheeler design features add up to substantial savings in the cost of steam generation. Equally important is the extra dependability that's built into every "SC" unit - the result of over 60 years of experience in the design and construction of large, high-pressure steam generators for leading central station power plants.

Pre-engineered in all details and standardized for economy, these FW standard steam generators are available for oil or gas firing, in capacities from 50,000 to 150,000 lb/hr, for pressures to 1500 psi and superheated steam temperatures to 950 F. For complete information, send for Bulletin B-55-4. Foster Wheeler Corporation, 165 Broadway, New York 6, N.Y.

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1. COMPLETELY WATER-COOLED WALLS

All furnace walls are cooled by closely-spaced tubes, minimiz-ing setting mainte-nance and preventing excessive exit gas tem-



2. EFFICIENT FIRING ARRANGEMENT

Burner argangement assures maximum rat-ing withou; overheat-ing furnace tubes. Rear wall is over 19 ft. from burner wall, permit-ting long, horizontal flame travel.



3. FULLY DRAINABLE SUPERHEA

A completely drainable superheater permits re-moval of all condensed



4. HIGH STEAM PURITY

The normal drum in-ternals consist of chev-ron dryers and a dry box. Separators may be added which make pessible a steam purity of IPPM or less.



5. UNRESTRICTED CIRCULATION

Absence of headers provides free circula-tion through integral risers and downcom-ers, eliminating header hendhole plates and



6. BOTTOM SUPPORTED UNIT

The bottom-supported design fully utilizes the structural strength of the tubes and provides low unit stresses in all members.



7. PRESSURE-TIGHT CASING

The all-welded casing forms a rigid, pressure-tight unit that can be arranged for pressur-ized or balanced draft



8. MINIMUM REFRACTORY BAFFLING

The wall separating fur-nace and boiler bank is the only rafractory baffling used. It is com-pletely accessible from



9. SIMPLE SOOT BLOWER ARRANGEMENT

Soot blowers are sup-ported on the outer row of boiler-bank tubes, simplifying alignment and provid-



ered via a glass tube from it. An annular space in the cell wall provides a passageway for easy removal of hydrogen. Caustic soda is tapped from the cell base.

Experimental Hookup — To get a close performance comparison between the new design and the smaller unit, Diamond hooked the big cells into its existing 20,000-amp. cell room at Deer Park. They replaced smaller units at the end of regular operating circuits.

But with those circuits designed for a top current of 24,000 amp., temporary copper oxide rectifiers were installed to superimpose the difference in ampere load on the existing circuit. Feed to the new units is 440 volts a.c., stepped down by the rectifiers through an insulating transformer.

At a load of 33,000 amp., average cell voltage is 3.94, current density 0.92 amp./sq. in. and cell liquor temperature 199 F. Cell liquor runs some 0.54 parts NaClO_z/1,000 parts NaOH and 1,600 parts NaCl/1,000 parts NaOH.

▶ Diaphragm Plus Mercury—In addition to redesigning its diaphragm cell, Diamond is currently expanding the Deer Park installation with giant 120,000-amp. mercury cells (see Chem. Eng., Apr. 1957, p. 146). These parallel developments point up Diamond's economic thinking concerning the two cell types.

Diaphragm cells, especially big ones like the new 30,000-amp. units, are attractive because they require less capital, power and brine-feed investment. But, to get a marketable caustic product, the dilute cell liquor from these units must be concentrated and reduced in salt content via evaporation.

Mercury cells, on the other hand, produce a high-purity, concentrated, salt-free caustic directly, that's marketed as premium rayon-grade product. But to do the job they need, along with more power, a cell feed of high-purity solid salt which is usually supplied as rock salt or by evaporating brine.

Diamond feels that the two cell types can work, advantageously, hand in hand, particularly in an area of low power costs like Deer Park. The company plans to use the high-purity salt dropped out during the evaporation of diaphragm-cell liquor as its mercury-cell feed. This beats buying costly rock salt or installing brine evaporators for the mercury cells. And, with both cell types on stream, it will be able to supply both grades of caustic from a single facility.

Germany Seeks Spotlight In Chemicals, Synthetics

Posting annual reports and forecasts, German chemical processors record a good year for 1956 and predict an even better one for 1957. And every day, new developments stem from this aggressive German industry.

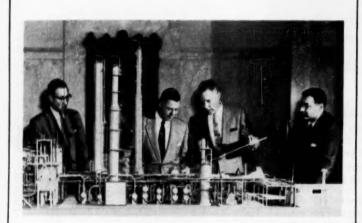
Farbenfabriken Bayer, of Leverkusen, West Germany's top chemical producer, expects 1957 sales to be about \$476 million, topping last year's by more than 25%. By 1958, Bayer foreign investments are scheduled to reach about \$40.5 million. New plant and equipment spending in 1957 will at least equal 1956's \$64 million. Production of Dradon acrylic fiber (corresponding to Orlon) is slated to jump 5,000 tons/yr.

Farbwerke Hoechst reports 1956 sales of \$353 million-16½% over 1955. The firm has added a new cracking unit to make ethylene and looks forward to big boosts in plastics production. Hoechst recently established a dyestuff plant in New York City, Progressive Color and Chemical Co., and expects a Brazilian subsidiary to start production near the end of the year. Spanish subsidiary, Electro-Quimica de Flix, by adding a new vinyl acetate plant, has boosted plastics output.

Other developments: Stoff-Fabriken AG has started up a cord nylon plant at its subsidiary, Obernburg, Main. First output will be used for testing

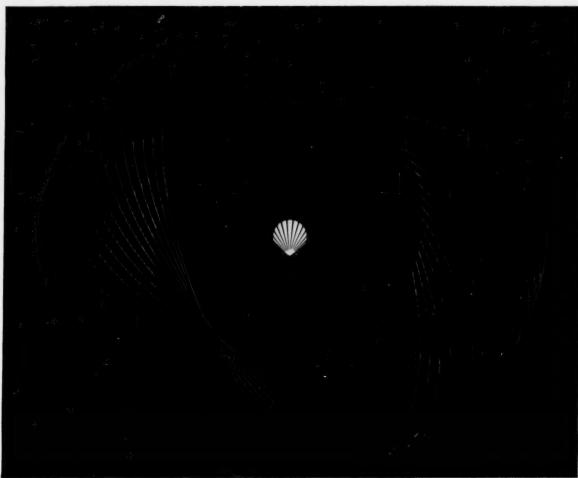
in tire production.

Demag (Duisberg), Lurgi (Frankfurt) and Siemens and Halsk (Berlin) are building an 85,000-ton/yr, nitrogenous ferti-



Model Reformer Goes to School-To Teach

Put on display recently at New York University for the benefit of chemical engineering students, this model catalytic reformer was used as a teaching aid in organic technology. Built by M. W. Kellogg Co., model measures a sizable 12x5x5 ft., is made entirely from new synthetic materials. Model is scaled at ½ in. to 1 ft., has now gone to Pure Oil Co. (whose catalytic reformer it represents), where it's used for training operators.



"Integration," an impression by C. Arthur Rosser

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lizer plant at Naju, South Korea.

Researchers at Wacker-Chemie, GmbH., Burghausen, have come up with a better coldvulcanizing agent for silicone rubbers-dibutyl tin dilaurate. Dilaurate gives silicones better heat resistance. Asymmetric siloxanes are especially suited for the method.

In East Germany, biggest

chemical producer, Veb Leunawerke, near Merseburg, is intensifying research on highly fluid epoxy resins, with an eye to upping production. And Veb Zellstoff und Zellwollwerke, Wittenberg, recently started up East Germany's first cellophane plant, is planning a second



ELECTRON DIFFRACTION TECHNIQUE

Probes Surface Phenomena

Electron diffraction, similar in principle to X-ray diffraction, holds promise of becoming a widely used industrial tool.

Electron - diffraction instruments, according to General Electric's X-ray department in Milwaukee, Wis., should prove useful in probing such surface phenomena as corrosion, catalysis, lubricating films, powder metallurgy and boiler-scale formation.

Many such studies, explains GE, lie outside the domain of X-ray diffraction because X-rays, in effect, lack the surgical "soft touch" of electrons.

▶ Electrons Are Gentler-Most important difference between X-ray and electron diffraction is that electrons don't penetrate as deeply as X-rays, can inspect samples as thin as 15 Angstrom units (4 millionths in.). X-rays, on the other hand, give infor-mation relative to the average cress-section.

So electrons make a far finer tool for determining surface composition and crystal structure.

Here are other advantages of electron diffraction:

· Smaller crystal sizes can be estimated, since electrons are diffracted by shorter atomic crystal-plane spacings. This is because, for practical accelerating voltages, electron wavelengths are about one-twentieth that of X-rays.

· An electron beam is much easier to collimate and reduce in size than an X-ray beam.

· Because an electron beam is highly monochromatic, sharper diffraction patterns are cast.

► How Instrument Works — A heated filament, the electron source, operates at a fixed potential, negative with respect to ground. Filament voltage can be varied from 20 to 50 kv. To maintain a constant temperature, filament is heated with a separate radio-frequency source.

Resulting electrons are accelerated through a grounded, apertured anode and focused, by

means of an electromagnetic focusing coil, on a fluorescent screen in the camera chamber.

Here are some practical applications of electron diffraction:

· Surface reactions-In corrosion processes, the instrument can detect earliest changes and help identify their chemical nature. In catalysis, the usual analytical methods may show one reaction mechanism, while electron-diffraction photographs would reveal another very thin layer responsible for catalytic action.

· Surface composition and characteristics - For pigments, lubricants and metallurgy, surface conditions are the key to performance and production control. Electron diffraction puts the finger on crystal structure, interaction of surface films and alloy interfaces.

Carbide Hustles Metals Program for Ti, Mn, Cr

Union Carbide Corp.'s Electro Metallurgical Div. is steadily pushing ahead on a vigorous expansion program. Latest spurt is in the form of new facilities in the Southeast for titanium mining and processing of manganese and chromium ores from various parts of the world.

Titanium processing mill and auxiliary equipment, to rise on Amelia Island, 30 mi. northeast of Jacksonville, Fla., will start up next spring. Operating crews will work on a 24-hr., 7-day basis. Carbide expects to recover about 15 tons/hr. of heavy minerals.

Titanium - bearing concentrates will be shipped to Electromet's Ashtabula, Ohio, titanium sponge plant, which is already turning out Ti sponge at peak 7,500-ton/yr. rate. Proved heavy-mineral reserves at Amelia Island include ilmenite. rutile, zircon and monazite (containing thorium).

Warwick, Va., will be the site for Carbide's manganese and chromium ore processing plant. New facilities, also expected on stream next spring, will grade and classify 30,000 tons/mo. of ores and ship products to Electromet's plants for making into ferroalloys.

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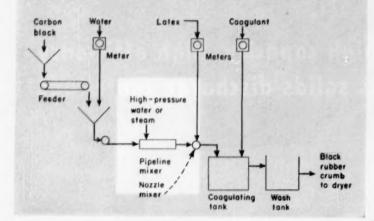
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New Way to Stronger Rubber

Dispersion of carbon black in turbulent stream of water, followed by mixing with latex, may lead to longer-wearing tires and lower processing costs.

Four major rubber companies—Goodyear, Goodrich, Firestone and General Tire—have within the past six months taken licenses with Columbian Carbon to use the latter's new process for putting carbon black into rubber, natural or synthetic, at the latex stage. All are now conducting experiments to decide whether to put the process into production and to what extent.

Road tests in three different tire plants already credit Columbian black rubber with an average of 15% better wear than conventional Banbury-mixed tire compounds. This improvement is even more marked in comparison with World War II-developed methods for latex masterbatching of carbon blacks, still generally used, which produce tires of 5-10% less wear resistance than Banbury-mixed compounds.

► Takes Full Advantage — According to Columbian, its new process affords fuller use of carbon black's potential reinforcing

164

properties. Optimum spatial distribution of carbon black in rubber and better black-to-rubber bonding have been achieved. In addition to better wear, Columbian credits its rubber with slightly faster curing rate, better processability and better hysteresis.

Columbian has been operating a pilot plant at Hancock, La., for several years. Briefly, process involves dispersion of carbon black in any form in a violently turbulent stream of water flowing through a pipe about 6 in. dia., without any kind of grinding, dispersing or peptizing agent. Keeping the black in suspension by continued violent agitation, the slurry is then mixed with the latex in a similarly turbulent state-either in the original pipe or in an adjacent nozzle. Rapid, complete and uniform mixing is attained.

Less Work for Mixer—Columbian believes that Banbury mixing and milling techniques have been going in the wrong direc-

tion both as to product quality and processing ease. They have been tending to the use of more and more brute force and expensive power to smear black and the tough rubbery elastomer together. Vigorous mechanical working sometime does violence to properties of the finished rubber product.

Old latex masterbatching methods have used preground black and several chemical additives-dispersing and stabilizing agents, caustic soda for pH adjustment, salt or other creaming agent-to achieve the proper mixture of carbon slurry and latex. But upon coagulation, unlike Columbian's experience, substantial portions of carbon black remain in the serum. Resulting disproportionate amounts of carbon black in the rubber have caused generally inferior endproduct properties.

► Easy Processing—Totting up Columbian's processing advan-

• Speed—Time lapse between initial contacting of slurry with latex and subsequent coagulation in an adjacent tank is in the order of 2 sec. Process is continuous, whereas previous latex masterbatching has been essentially a batch operation taking a matter of hours—even days. Process speed also contrasts with tediously long Banbury mixing.

• Low equipment cost — Pieces of equipment required by the new process are small and relatively few. Grinders and 9,000-gal. mixing and storage tanks for preformed carbon black suspension used in old masterbatching methods are eliminated. Because carbon black constitutes the major ingredient to be compounded with rubber, tire plants doing their own black mixing with two Banburys could cut back to one if they started with Columbian rubber.

• Space saving—Cutback in size and number of equipment items makes for minimum space requirements, both at the masterbatching plant and the tire factory.

Need for improvement in the black masterbatching process is pointed up by recent production figures. They show a decline from 132,000 long tons of black

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In addition to Stannous Chloride, Baker also has available Stannic Chloride, both as the anhydrous liquid (SnCl₄) and as the crystalline pentahydrate (SnCl₄ · 5H₂O).

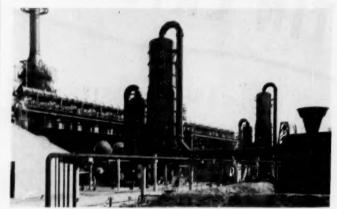
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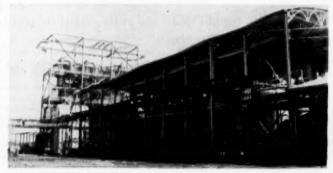
Butadiene, Rubber: Big Bounce in Houston



BUTANE DEHYDROGENATION UNITS at Texas Butadiene's plant near Houston, using single-step process, will soon be belching out 61,000 tons/yr. of butadiene.



BUTADIENE FACILITIES of Petro-Tex Chemical Corp. have been expanded, will boost butadiene output from 90,000 to 200,000 tons/yr. for nearby Goodyear rubber plant.



GR-S RUBBER REACTORS—22 of them, all new—up capacity of Goodyear's Houston plant by 50%, to 220,000 tons/yr. Each new reactor has 5,000-gal, capacity.

masterbatch in 1952 to 99,000 long tons in 1956. A total of about 1 million long tons of black rubber was produced last year. But many end-product manufacturers have preferred to Banbury mix or mill in black themselves. Explains Columbian's process inventor H. A. Braendle (U. S. 2,769,795), "Many tire plants simply couldn't afford to take a beating on quality."

► How Process Works — Examples of two variations of the new process give an idea of specific sizes and types of equipment and ingredient ratios:

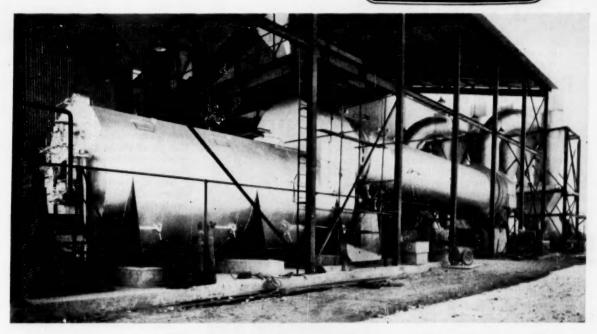
In one variation (see flow-sheet) actual contacting of slurry and latex takes place in a nozzle adjacent to the slurry-mixing conduit. Necessary hydraulic agitation is effected solely by impact of high-velocity fluid streams.

Carbon black at a uniform rate of 264 lb./hr. and water at a uniform rate of 1,800 lb./hr. are premixed to form a flowing stream. Stream is charged, as formed, under pressure to the slurry-mixing conduit through an inlet opening about ½ in. dia. Steam at a pressure of 160 psi. is charged to the slurry-mixing conduit at a rate of 213 lb./hr. so as to impinge, at a velocity of about 1,500 ft./sec., at substantially right angles upon the entering slurry of carbon black and water.

Resulting slurry is passed directly from the slurry-mixing conduit to a mixing nozzle. There it is uniformly blended with a stream of latex charged to the nozzle through a 1-in. inlet at a uniform rate of 2,780 lb./hr.

On leaving the nozzle, the latex-black mixture goes directly to the coagulating tank and immediately mixes with an acid coagulant, Rubber crumb is separated from the serum, washed and dried. Yield is about 790 lb./hr. of dried solid. Separated serum is found to be substantially free from carbon black.

In a second variation, both slurry mixing and slurry-latex contacting take place in zones of the same pipe conduit. Hydraulic agitation and impact is effected by means of a high speed mechanical blender, extending the length of the pipe. (Continued)





TO ENRICH THE SOIL FOR GREATER FOOD SUPPLY CALSPRAY'S NEW PLANT IS ON STREAM... WITH STANDARD-HERSEY DRYERS!

To provide better fruit, vegetables, meats...and lower farmers' "production" costs, California Spray-Chemical Corporation's new plant is now on stream at Richmond, California, increasing the production of its famous-forquality ORTHO Fertilizer. With a rated capacity of 300 tons-per-day, Calspray's new plant uses two job engineered Standard-Hersey dryers designed and built by the experienced engineers of Standard Steel Corporation...a world leader in better designs of dryers, granulators, and coolers. Wide range and flexibility are provided to make almost any desired grade of fertilizer.

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Regardless how tough the problem, if you're looking for a job-engineered rotary unit, you'll look to Standard Steel.

IF YOU HAVE A PROCESSING PROBLEM!

Standard Steel welcomes the opportunity to discuss with you any problems you may have in drying, cooling, or calcining. Our laboratory pilot testing equipment determines beforehand the best equipment for your problem.



STANDARD STEEL ACQUIRES LEADER IRON WORKS

To meet the ever increasing needs of its world-wide customers, Standard Steel Corporation recently purchased the Leader Iron Works at Decatur, Illinois. Founded in 1888, Leader is well known for its work in the food, chemical and petroleum industries. In addition to its customary fabrication. Leader will now manufacture Standard's line of heavy processing and road construction equipment.

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ROTARY DRYERS . KILNS . COOLERS . ASPHALT PLANTS

Carbon black at a uniform rate of 430 lb./hr. and water at a uniform rate of 4,800 lb./hr. are premixed and charged to the upstream end of a mixing conduit 4 in. I.D. and 30 in. long. Latex at a uniform rate of 4,525 lb./hr. is charged to the mixing conduit at a point about 10 in. from its outlet end. The agitator within the conduit is operated at a speed of about 5,000 rpm.

In general, for best results, the step of coagulating the latex mixture with a conventional acid coagulant should immediately follow black-latex mixing. By avoiding the usual step of raising the pH of the slurry to that of the latex before mixing the subsequent coagulation takes much smaller amounts of acid coagulant than customarily used.

Commercial Decaborane **Highlights Boron News**

American Potash & Chemical Corp. and Callery Chemical Co. are two firms figuring lately in developments in the boron field.

Ampot scores by starting up the first known commercial decaborane facility at Henderson, Nev. Output, in pilot-plant quantities, is being used to meet existing sales commitments. But Ampot is in a position to sell limited quantities for research purposes.

Callery has announced plans for its second new plant in the Midwest. The firm will build a boron specialties plant at Lawrence, Kan. To be built by Blaw-Knox, the facility will cost

\$3-4 million.

Reactor Research Probes Thorium to Up Core Life

Reactor experiments now under way at Babcock & Wilcox Co.'s laboratory near Lynchburg, Va., involve first use of large quantities of thorium as a fertile material. Use of thorium is a means of breeding fissionable material to prolong the life of a reactor core.

Fissionable material being used in the experiments is uranium-235. Thorium, when bombarded with neutrons, is converted to uranium-233, another fissionable material.

Experiment is a step in the development of power reactor which B&W is building for Consolidated Edison Co. at Indian Point, N. Y.



Fluid-Bed Calciner Ups **Phosphate Quality**

Shown above is San Francisco Chemical's fluid-bed calciner which is now at work on an experimental basis at Montpelier, Ida., to upgrade the quality of phosphorite and other low-grade phosphatic materials.

Calciner, engineered by Dorr-Oliver, is 48 in. dia. by 40 ft. high. In operation since last August, it's now running on a round-the-clock basis. According to Dwight L. King, SFC president, this is the first time that phosphate rock has ever been calcined by a fluid-solids

system.

▶ Burns the Carbon—Western phosphorite is a highly carbonaceous complex often referred to as phosphatic shale. By calcination at 1,250-1,400 F., the carbon can be burned out and the P,O, content raised correspondingly. (Quality of wetprocess phosphoric acid made from calcined rock is also improved.)

Fuel value of the shale itself will support combustion. Actually, it is sufficient to yield combustion temperatures up to 1,800 F. Therein lies San Francisco Chemical's hope for economical phosphate upgrading.

For the firm plans to combine fluid-bed calcining with a wet beneficiation process. The moist concentrates from the beneficiation plant would go to the phosphorite calciner, capitalizing on the extra heat for drying.

► Wet Upgrading—First units of a new 1,000-ton/day wet concentrator are just going into operation at SFC's Leefe, Wyo., plant. Final installations will be complete late next year.

Also engineered by Dorr-Oliver, the beneficiation plant will use a complex series of size-reduction machines, wet cyclones, classifiers, filters, thickeners and flotation cells to produce a phosphate concentrate.

►Low-Cost Mining-It's in the mining operation that President King predicts greatest economies. As King describes it, the most important deposits of phosphate in the West consist of several layers, some of which are of high grade (more than 31% P.O. content), with the rest being low-grade phosphorite.

Under most circumstances, however, the entire band will average 26-28% P.O. in place. "Obviously," points out King, "it's a great deal less costly to mine, say, 25 ft. of thickness than it is to mine 5-7 ft."

Ultimate aim, therefore, is to mine the entire phosphate band and upgrade the ore via appropriate processing steps. And the fluid-bed calciner occupies a key spot in these plans.

Possible Gasoline Twist: Isomerize, Dehydrogenate

In the all-out drive for superoctanes, dehydrogenation seems to be the latest likely process step tacked onto the promising isomerization route (Chem. Eng., Nov. 1956, pp. 128-130).

(Continued)

USING DU PONT ELASTOMERS



NEOPRENE connectors save \$1000 a year on hydrochloric acid pumps

Cover of HYPALON doubles life of elevator belt exposed to 300° F.

Engineers at a large chemical plant faced a problem of finding an elevator belting material that would resist high temperatures. The belt had to lift hot salt 27 feet from a rotary drying kiln to a loading platform. Heat caused ordinary rubber belts to become brittle, crack and rupture at points where the Monel buckets were attached.

A specially designed belt with a cover of Hypalon synthetic rubber did the trick. It lasted 6 months (the best rubber belts lasted only 3 months) driven 188 feet a minute, hauling hot materials. HYPALON gave this service despite the fact that the belt was totally enclosed and operated 80 hours a week.

The resistance of Hypalon to heat (250° F.-350° F.) is only one of its many useful properties. It offers outstanding resistance to ozone and strong oxidizing agents; resists abrasion, flex cracking, weather. It can be compounded in a wide range of stable colors. Mail coupon for details on how products made of Hypalon can lower operating costs for you.



Elevator belt has cover of HYPALON. Outlasted previous belts 2 to 1 handling hot salt.



Neoprene connectors on acid pumps withstand constant vibration without damage.

Chemical producer switched to neoprene when pump vibration cracked regular fittings

One of the country's largest chemical manufacturers handles great quantities of hydrochloric acid in making enduse products. Pumps are used to distribute acid from the storage tanks to process points. Trouble arose when the fittings connecting pumps to suction and discharge lines cracked under pump vibration. Several rigid nonmetallic materials were tried. All withstood the effect of the acid, but failed mechanically under misalignment stress.

Then the company substituted resilient neoprene connectors for the inflexible materials previously used. They worked. Neoprene connectors-resistant to flex fatigue-can compensate for shifting lines . . . can take distortion without damage. And neoprene connectors are resistant to HCl on the inside, to sunlight and weather on the outside. The change to neoprene saves this company \$1000 a year in labor and materials.

In tough service such as this, neoprene's balanced combination of properties pays off in longer wear, less maintenance. Neoprene resists acids, abrasion, heat, weather, oil and grease. This Du Pont synthetic rubber is used in a wide variety of industrial applications where conditions are severe. Hose, belting, gaskets, protective lining, safety clothing are examples. Mail coupon below for details on how neoprene can save you labor and expense.



Resilient fitting of neoprene takes stress which ruins rigid non-metal types.



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Houdry Process Corp. has been studying catalytic dehydrogenation of pentane-isopentane mixtures over chromia-alumina catalyst in a fixed-bed pilot unit. Houdry finds that dehydrogenation gives higher octanes (but lower yields) than does isomerization and that dehydrogenation is more flexible, utilizing a wider range of feed compositions.

Potentially attractive combination, says Houdry, is isomerizing feed to equilibrium and then dehydrogenating.

New Solution in View for Pollution-Plagued Pulper

In progress this summer are tests to measure effectiveness of a new method of maintaining satisfactory dissolved-oxygen conditions in river water below sulfite pulp mills.

Flambeau Paper Co. is running a month's-long test down-

stream from its pulp mill near Park Falls, Wis., to aerate the river water through modified power turbines at Pixley Dam.

For many years Flambeau has been testing at Pixley Dam an elaborate installation that reareates river water by compressing air and dispersing it as tiny bubbles through porous ceramic plates into the headrace and tailrace of the power station.

Purpose of the trials with a modified turbine is to compare efficiency of new method with that of the older compressor technique.

News Briefs

Lithium: American Lithium Institute has initiated a program of sponsored research on lithium alloys at M. I. T. and on lithium-containing glass at Pennsylvania State University.

Mental drug: Hoffman-La Roche, Inc., has discovered a new type of mental drug called iproniazid and tradenamed Marsilid. Marsilid differs from tranquilizers in that it seems to be effective with severely depressed patients who are sometimes made worse by tranquilizers.

Linear accelerators: Applied Radiation Corp. has started commercial production of high-power electron linear accelerators at its Walnut Creek, Calif., plant. Accelerators with beam energies of from 2 to 80 mev. are available.

Boron: U. S. Borax & Chemical Corp. has unearthed a large tincal ore body at the company's new open-pit mine at Boron, Calif. The opening of the pit uncovers the largest known sodium borate ore body in the world.

Atom-powered ship: U. S. Maritime Administration has awarded a contract for design of the first atomic-powered surface ship to George G. Sharp, Inc., New York marinedesign firm, and Walter Kidde Nuclear Laboratories, Garden City, N. Y.

Gold, uranium oxide: Merriespruit (Orange Free State) Gold Mining Co. will restore production at its mine in South Africa. Kennecott Copper has a substantial interest in this gold and uraniumoxide-bearing property.

Additive: Standard Oil Co. (Ind.) reveals this much about the additive in its new "100%-science-produced" gasoline: It's a phosphorus compound (probably not a phosphine), will be made by a "member of the Standard family" (not Amoco).

Barium monohydrate: Sherwin-Williams Co. will build a barium monohydrate plant near its Coffeyville, Kan., barium carbonate plant. New unit, to cost over \$1 million, will use a new process, will be on stream early in 1958.



British Synthesize Cortisone on Commercial Scale

From the bubbling batch you see above, Boots Pharmaceutical Factories, Nottingham, England, will extract synthetic cortisone. Picture shows the last step in a lengthy series of reactions. Raw material is hecogenin, obtained from sisal.

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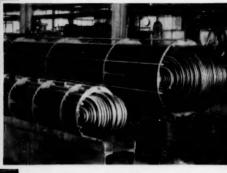
Unscrew cap and screen comes out with it.
When replacing, put screen in cap, then screw cap into body. Straight threads assure correct alignment, no screen distortion. Cap is tapped for pipe plug or blow-off line.



FINE SCREEN STRAINERS

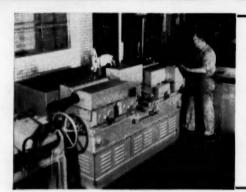
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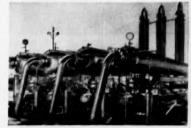
Here are more Republic products widely used by petroleum processors

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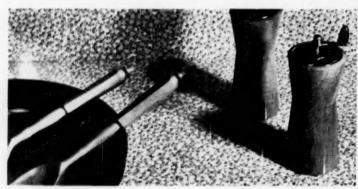
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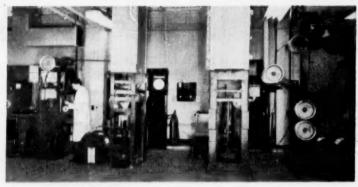
Cresylics Users Get More Stable Supply



FOR PHENOLIC RESINS . . .



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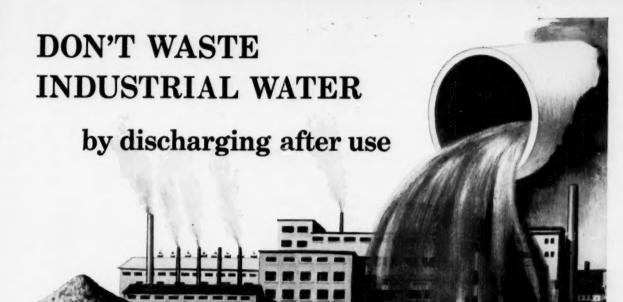
New plant output promises to make cresylics supply more reliable in terms of volume, uniformity and purity of product.

New Pitt-Consol Chemical plant in Newark, N. J., with an expected 20-million lb./yr. output of phenols, cresols and cresylic acids comes close to meeting the amount for which domestic users have had to go to skittishly-priced imports during recent years.

First commercial installation of a company-developed refining process (see p. 228), plant is also the first cresylics plant to operate continuously. In terms of product quality, superior process control offered by continuous operation means better uniformity as to basic composition and purity levels than older batch processes are able to guarantee.

Troublesome impurities such as sulfur, neutral oil and tar bases have been reduced to the point where they are no longer a factor in consumer processing. Key innovation of the new Pitt-Consol process is the continuous extraction of impurities prior to fractionation of feed into marketed products. Extraction step brings various impurities down to a fraction of those present in older batch products, according to company spokesmen.

▶ Eager Markets — Standard products now offered by the new plant include phenols, 98% or 90-92%; ortho-cresols and meta-para-cresols in a range of percentages; various xylenol mixtures. Biggest market for most of these is in phenolic resins which will consume about 35 million lb. of cresylics in 1957, about 55 million by



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A Celite engineer will be glad to study your water problem and offer recommendations with no obligation. Write Johns-Manville, Box 14, New York 16, N. Y. In Canada, Port Credit, Ontario.

*Celite is Johns-Manville's registered trade mark for its diatomsceous silica products

Johns-Manville CELITE diatomite filter aids

Cresylics users get stabler supply174A
Silicone rubbers gain new strength178A
Silicone rubber withstands tearing better . 178B
More high purity dipentadiene178C
Antifoam does big jobs fast
Hyper-pure silicon regraded, repriced178E
New producer for hyper-pure silicon178F
Stretched acrylic resists shatter180A
Piperazine in new flowing form180B
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1960-61. Second biggest market is tricresyl phosphate, to take about 35 million lb. in 1957, 47 million in 1960-61. Some other takers: wire enamel solvents, ore flotation reagents, metal cleaners, disinfectants, solvent refining.

► Consistent Purity — In these applications, dependable consistency of high purity product afforded by unique continuous processing eliminates the possibility of troubles like the following. If too much sulfur is retained in cresylics, their reaction with formaldehyde to make phenolic resins may be inhibited. In wire enamel solvents, it can cause poor adhesion of coating to wire. It causes odor in phenolics, and it causes unwanted color in TCP. Retention of too much tar base can have an undesirable catalytic effect, cause color bodies in TCP.

Present Pitt-Consol plant is based on petroleum sludge feed. But by 1960, company plans to complete a 40-million-lb./yr. cresylics plant in Cresap, W. Va., using the same continuous refining technique but fed also by liquids from low temperature coal carbonization. Both plants will thenceforth be served by both feeds. With the two-plant total of at least 60 million lb./yr., 2itt-Consol will then be the biggest contributor to the nation's predicted

250-million-lb. cresylic output for 1960.

► Two-plant Flexibility - Pitt-Consol is conducting product and market development with an eye to the coming two-plant setup as well as to the present. For example, meta-para-ratio of present petroleum-derived product is high, ie. 2.8. In general, this is an asset in the phenolics market because meta product offers three reactive positions for polymerization whereas the para product has only two. However, meta-para ratio of LTC-derived product is down around 1.4. Blending of these high and low ratio fractions will give the company unique flexibility in product range. It will be in a position to offer products tailored to fit specific customer needs.

► Xylenols Fight Imports — Present petroleum-derived product runs high in the cresols

and low in xylenols; just the opposite is true of LTC product. Pitt-Consol sees room for substantial amounts of 14¢/lb. ortho-cresol in many of the phenolic applications which are now largely based on 18¢/lb. phenol. Further, company is using orthocresol as the basis for alkyl substituted phenols which it is now producing in laboratory quantities.

But xylenols loom largest in the company's future since they are largest fraction to come from virtually inexhaustible supplies of LTC liquid. It is in this range that most cresylic imports have fallen. Of the 23-25 million lb. of cresylic imports expected in 1957, 20 million lb. will be xylenols. Pitt-Consol spokesmen predict that the total import figure will not change much by 1960-61, whereas company's own xylenol output will have reached 18 million lb./yr. Increased domestic output will stabilize price fluctuations. Though import prices have traditionally followed domestic schedules, they peak above the highs and drop below the lows.

Growing markets for xylenols in tricresyl phosphate. Cresylics which are used to make TCP for gasoline additives are made up of a mixture of cresols and xylenols; TCP in hydraulic fluid operation is made principally from xylenols and higher boiling

For More Information . . .

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Reader Service

postcard inside the

From Heyden Newport

The High Polymer Alkyd Technique*

A need existed for speeding the drying rate of long oil alkyds – correcting the slower dry and longer tack time experienced with some fatty acids, particularly those derived from tall oil. As part of its technical service a study of the alkyd resin as a polymeric system by the Heyden Newport Research Department resulted in a technique for achieving these properties and opened large areas of application for materials readily available at low cost. This technique is adaptable for fusion or solvent processes and particularly suitable for the manufacture of long oil alkyds from pentaerythritol and tall oil fatty acids. Heyden Newport supplies pentaerythritol technical (Pentek®) and a full line of related polyols and tall oil fatty acids.

The High Polymer Alkyd Technique involves the formation of a greater proportion of high molecular weight alkyd fractions by a stepwise esterification of the fatty acids in the alkyd formulation. The resin is prepared by reaction of all of the polyol and all of the dibasic acid with an initial quantity of fatty acid, esterifying to a low acid number and then adding the

remainder of fatty acid and again esterifying to a low acid number.

The viscosity of this type of alkyd is higher than that of conventionally prepared resins and the resin colors are frequently lighter.

Film property evaluation of "drying oil" fatty acid modified alkyds indicates considerable increase in dry rate and alkali resistance properties for the high polymer alkyd resins. Long oil alkyds made from tall oil fatty acids dry within reasonable time.

Other improvements noted so far include better flexibility, adhesion, freedom from baking discoloration, and detergent resistance.

A fractionation technique applied to these and conventional alkyds shows that higher molecular weight species are made to greater degree by the stepwise esterification.

*From a paper presented by Dr. William M. Kraft, Research Department, Heyden Newport Chemical Corporation, at Vehicle Manufacturers' Group of New York Paint, Varnish and Lacquer Association, Inc., New York, March 13, 1957. Copies available upon request.

HEYDEN NEWPORT
CHEMICAL CORPORATION
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Where tradition meets tomorrow in chemical progress



alkylated phenols.—Pitt-Consol Chemical Co., 191 Doremus Ave., Newark, N. J. 174A



Silicone Rubber

High tear and tensile strength added to silicone rubber properties.

Two companies, General Electric and Dow Corning, have announced almost simultaneously new silicone rubber products with a degree of mechanical strength and abrasion resistance heretofore available only in conventional organic rubber.

Both products retain the unusual temperature resistance of the silicones and are useful over a -130 to 500 F. temperature range. They make possible airframe seals, for example, far more rugged than any now in high-temperature service. Other suggested applications include: over door gaskets, wire and cable coatings and oxygen masks.

Dow Corning's product is called Silastic 916. Typical properties include tensile strength in the range of 1,500 psi., a 50% increase over comparable silicone rubbers. Tear strength is approximately 200 ppi., an increase of 100%. Elongation is over 500% and durometer is from 50 to 60 on a Shore A scale.—Dow Corning Corp., Midland, Mich.

General Electric's new product, designated 81716, shows improvements of similar kind and magnitude.—General Electric Co., Waterford, N. Y. 178B

Dipentadiene

New commercial source of high purity material.

New commercial source of high-purity (95%) dipentadiene may add to present major applications as a raw material for making insecticides, printing inks, resins and drying oils.

It will combine easily with a large variety of unsaturated acids and aldehydes to form cyclic and bicyclic compounds. It also lends itself to the production of such products as ketones, fulvenes and oximes and has the capacity to produce metallic derivatives.—Enjay Co., 15 West 51st St., New York, N. Y. 178C

Antifoam

Knocks foam down fast; periodic use prevents formation.

New antifoam agent was designed for and has solved a severe foaming problem at Upjohn Co.'s antibiotic waste reduction plant. But it is also expected to have application in municipal waste treatment plants and in a variety of industrial waste treatment processes involving proteinaceous material: dairy, brewery, citrus and cannery wastes and wastes from starch, milling and malting operations.

Called Hodag S-118, it succeeded in taming foams reaching 6 ft. or more at Upjohn's Kalamazoo, Mich., plant. Older agents had been tried and found unworkable. Hosing and sprays had succeeded only in spreading foam over a wider area.

Upjohn now reports a Hodag S-118 usage of 10 ppm. for effective foam control. This amounts to an average cost of approximately \$1/day, or 1¢/thousand gallons of waste processed. This is more than made up by reduced maintenance costs.

▶ Prevents or Cures—Application of antifoam at periodic intervals prevents the foam from ever forming. Once formed, it can be knocked down in just 2 min. The new antifoam is based on specially fractionated vegetable oils not harmful to bacteria growth. Dark amber in color, it weighs 7.4 lb./gal, is a free-flowing liquid that requires no heating or special handling before application.

It can be applied manually as well as automatically, can be closely regulated and doesn't clog injector nozzles. It is non-corrosive and can be used in plain iron equipment. It is stable for long periods of storage.

At Kalamazoo, Hodag S-118 is applied by means of a spray system. It controls greater quantities of foam, and much more stable foam, than that usually encountered in municipal sewage treatment plants. This foam is produced by antibiotic spent beers which make up a substantial proportion of the plant's average daily flow of 100,000 gal.—Hodag Chemical Corp., 7247 North Central Park, Chicago 45, Ill. 178D

Hyper-Pure Silicon

Two producers announce new prices and grades for electronics customers.

Du Pont has now established four separate grades of its hyper-pure silicon at generally lower prices. Texas Instruments Co., which recently made its debut as a commercial producer, has also announced grades and prices.

Three of Du Pont's new grades are semiconductor silicon. Grade No. 1, said to contain no more than three parts per billion of boron—a critical impurity, is priced at \$360/lb. Du Pont describes it as an entirely new grade developed for power rectifiers and power transistors destined for high voltage applications.

Company describes Grade No. 2—price, \$250/lb.; purity, 6 parts per billion of boron—as corresponding to the bulk of semiconductor silicon used in the majority of existing applications.

Another new type, Grade No. 3, will be used in devices for low-voltage applications. It



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cosis \$160/lb.; purity, less than 11 parts per billion of boron.

Solar cell grade, which has been used in solar batteries for telephone line power, radios and toys, has been reduced from \$150 to \$100/lb.—Du Pont Co., Wilmington, Del. 178E

Grades and prices announced by Texas Instruments upon its entry into the open market seems to belong to a somewhat different jig-saw puzzle. Unlike Du Pont, TI emphasizes total impurity content rather than boron alone in its purity ratings.

Research grade, rated on the basis of total impurities at less than one part per billion, is slated for developmental work, costs \$980/lb.

TI's premium grade seems to compare roughly with Du Pont's Grade No. 1 as to stated application goals: high frequency transistors, high voltage rectifiers and infrared optical components. But price is \$500/lb. Standard grade, at \$320/lb., is said to be suitable for small signal transistors, low voltage

rectifiers and diodes, and solar converters.—Texas Instruments Co., Houston, Tex. 178F

Piperazine

Two new forms increase usefulness in livestock deworming.

Two companies have announced commercial production of new forms of piperazine, each said to increase its usefulness in deworming. Piperazine was found to be effective as an anthelmintic in the treatment of roundworms in poultry and swine about two years ago, with characteristics superior to other compounds used. Prior to this discovery, it had only limited use as an intermediate.

Jefferson Chemical Co., Houston has developed a new, freeflowing form of high purity piperazine. Until recently, anhydrous forms of the material were available only as a solid, usually in cake form, which resulted in compounding difficulties. The Jefferson product is shipped in 100-lb. fiber drums, ties. New product is shipped in 100 lb. fiber drums, with a polyethylene inner bag.—Jefferson Chemical Co., Houston, Tex. 180B

Union Carbide Chemical Co., New York, has developed piperazine salts, said to be a more convenient form of the active piperazine ingredient because: They are easy to administer, generally given in drinking water (about 0.1%) or in feed (about 0.2%); they are 90 to 100% effective.—Union Carbide Chemical Co., New York.

Methyl Butynol

Base for organic syntheses is stable but has reactive triple bond.

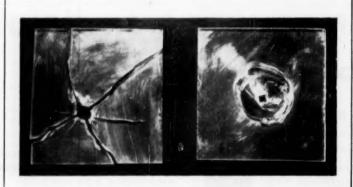
Methyl butynol (2-methyl-3butyn-2-ol), a tertiary acetylenic alcohol, is about to move into commerical production for the first time in the United States.

Both methyl butynol and methyl pentynol (also to be produced) retain the triple bond of the parent acetylene, but are themselves completely stable and therefore present no handling and storage problems. In addition to the triple bond, both alcohols have two other points of reaction: at the hydroxyl group, and acetylenic hydrogen.

The isoprenoid structure and the chemistry of methyl butynol and methyl pentynol have led to their use as starting materials in the preparation of flavors, perfumes, pharmaceuticals and speciality monomers. Among the more promising derivatives of methyl butynol are isopropenyl acetylene (already in semicommercial production by company), methyl butenol, and 3-methyl-3-hydroxy-2-butanone.

Methyl butynol also has direct uses of its own. It is an acid corrosion inhibitor, a scavenger of HCl in chlorinated solvents, a brightener in metal plating, and is in itself, a specialty solvent.

Methyl pentynol has uses similar to those of methyl butynol, but has hypnotic char-



Stretched Acrylic, Right, Resists Shatter by Bullet

Stretching improves toughness of acrylic plastic sheets enough to make them usable for aircraft glazing without the lamination formerly required. Commercial application has recently begun based on results of several years of testing.

Molecular orientation created by multiaxial stretching appears to greatly increase resistance to crazing. A typical test showed acrylic material stretched 150% almost completely craze-resistant. Strain at failure, a measure of toughness, was increased from about 7% for unstretched material to 50 and 25% for 100%- and 150%-stretched material.— National Bureau of Standards, Washington 25, D. C.

180A

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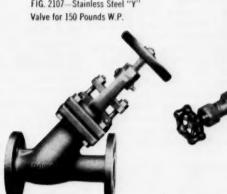
FIG. 2309-Flush Bottom Tank Valve for 150 Pounds W.P.

FIG. 2491 - Stainless Steel O.S.& Y. Gate Valve for 150



FIG. 1886 Stainless Steel Liquid Level Gauge for 350 Pounds W.W.P. Offset pattern.

FIG. 2107-Stainless Steel "Y" Valve for 150 Pounds W.P.



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acteristics that have been successfully employed, particularly in Europe. One intriguing use has been by fish and game authorities to tranquillize live fish to prevent self-injury in shipping tanks.—Air Reduction Chemical Co., 150 East 42nd St., New York, N. Y. 180D

Rubber Accelerator

Fast-curing, it adds ageand wear-resistance.

Designed as a special-purpose accelerator, 2-MT, or 2-mercaptothiasoline, has been shown by tests to contribute to vulcanizates such superior properties as higher modulus, increased age resistance, retention of tensile strength and tear resistance at elevated temperatures, greater resistance to flex-cracking and reduced heat build-up.

A creamy white powder, nontoxic in normal industrial use, 2-MT is adapted particularly to compounding rubbers for tires, belts, mechanical goods and other use requiring good ageing and retained resilience.

For another of the company's rubber accelerators, MBTS (benzothiazyldisulfide), new production and packaging facilities are improving use characteristics and extending shipping and storage convenience. Improved MBTS has achieved new high qualities of freedom from dust, excellent dispersibility and uniform particle size.

Operation of new production equipment has produced an MBTS free of oversized particles normally present. Dedusting and lubricating additives are thoroughly distributed. Ash is minimized and all magnetic iron particles completely removed.

New packaging equipment utilized a vacuum packer which makes more effective use of bag capacity. It exhausts the air normally included in the valve type bag packing operation, yet permits the MBTS to retain all its free-flowing characteristics. Palletized unit loads of 2,000 lb. are now available with cubic spaced reduced about 20%.—American Cyanamid Co., New York, N. Y.

BRIEFS

Pesticide, commercially available this year, has already been recommended by various state authorities for use on cotton. Three years of tests have shown it controls an unusually wide range of pests and has long-lasting residual effectiveness, Called Hercules 523, it is described as dithiophosphate of dioxane. It possesses a lower degree of toxicity to warm-blooded animals than most phosphate insecticides now on the market. Hercules Powder Co., Wilmington 99, Del.

Resin-emulsion glue sticks to unwettable siliconetreated vials and bottles. Called Glastck 9499, it will actually penetrate the silicone layer on any glass container to bond on the glass surface underneath. Laboratory tests show its bond is well within the requirements of Army-Med specifications for water immersion and the adhesive is already in use for keeping labels on pharmabottles. — Paisley Products Inc., 630 West 51st St., New York, N. Y. 182C

Three sesquiterpene fractions have been made available for the first time in commercial quantities. Major applications are in aromatics and fine chemicals. Top grade features beta caryophyllene about 90% pure; second grade contains between 75 and 80%; third grade is of interest only where chemical purity or good organoleptic property is not required.—Glidden Co., Cleveland, Ohio.

For More Information . . .

about any item in this department, circle its code number on the

Reader Service

postcard inside the back cover

New low-pressure polyethylene is said to make pipe which is superior to any yet produced in terms of high working pressures and temperature resistance and absence of stress cracking (see p. XXX). These properties are ascribed to high molecular weight (over 750,000) and molecular structure not present in any other known polyethylene. New resin is expected to have wide use in other phases of the plastics filed such as tubings, films, sheets, tiles, moldings and fibers.—Allied Chemical & Dye Corp., 61 Broadway, New York, N. Y.

New medium viscosity polyvinyl chloride resin, Pliovic S70, fluxes at lower temperatures than many higher weight resins, can be calendered, extruded or injection molded. Small-particle size resin (average size, 40 microns), it is expected to find major application in the calendering of film and sheeting.—Goodyear Tire & Rubber Co., Akron, Ohio.

High boiling solvent, 3-methoxy butanol, offers to the lacquer industry slow evaporating rate, high solvent power and high diluent tolerance. For heavy duty brake fluids, it is an excellent coupling agent. It's an intermediate in the production of phthalate and phosphate plasticizers, urea-and melamine-formaldehyde resins.—Celanese Corp. of America, 180 Madison Ave., New York, N. Y. 182G

Emulsifier from sugar, first to be introduced to industry, is available in pilot plant quantities. Marketed as Sucrodet D-600, the surface active agent is a recrystallized sucrose dipalmitate, developed primarily for utility in food, pharmaceutical and cosmetic industries. Within a few months, company plans to produce sucrose esters derived from stearic, oleic, myristic and lauric acids.— Millmaster Chemical Corp., 295 Madison Ave., New York, 182H N. Y.



Basic raw materials for DETERGENTS that leave every glass with a "Crystal Sparkle"

There is solid sales-appeal in a detergent for home or restaurant use that leaves every glass with a "Crystal Sparkle." Marketing one of these new detergents will put new sparkle in your sales chart, too!

Every manufacturer of detergents should investigate Enjay Tridecyl alcohol, Tripropylene and Tetrapropylene—high-quality petrochemicals that can play key roles in the manufacturing process. These, and other Enjay petrochemicals, are making significant contributions in the manufacture of many products characteristic of the modern American standard of living.

The modern, well-equipped Enjay Laboratories have recently been expanded and are at your service in the application of any Enjay petrochemical. Call or write for further information.

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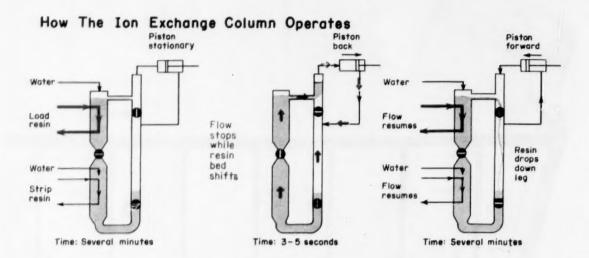
ALCOHOLS & SOLVENTS: Lower Alcohols, Oxo Alcohols, Ketones and Solvents; OIL & FUEL IMPROVERS: Detergent Inhibitors, V-I Improvers, Oxidation Inhibitors; CHEMICAL RAW MATERIALS: Olefins, Diolefins, Aromatics; ENJAY BUTYL RUBBER & VISTANEX.



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PROCESS EQUIPMENT EDITED BY C. S. CRONAN



Ion Exchange Column Runs Continuously

Now available commercially, the A.E.C.-Higgins contactor combines high throughput and low theoretical stage height with essentially continuous flow.

Recent completion of the first Higgins continuous ion-exchange contactor built for sale by a private company marks the entry of this A.E.C.-proven process system into the commercial market.

It offers the prospective user the advantages of continuous, countercurrent flow operation without sacrificing the features of high throughput and low theoretical stage height associated with fixed-bed opera-

In the Higgins contactor, the liquid flows downward against a packed bed of resin. This procedure avoids the danger of fluidization which is inherent in most other proposed continuous ion-exchange devices. clear solutions and incompletely filtered slurries such as uranium-ore leach pulps can be processed by the unit.

Covers Broad Range - Hig-

gins' contractor is suitable for all types of ion-exchange processes. Inlet and outlet streams can be arranged to carry out continuous recovery and concentration of an ion, separation of two ions, and other types of ion-exchange operation.

Range for this system extends from large-scale, highspecific-flow-rate applications such as water conditioning and hydrometallurgy to small-scale special applications such as separation of rare earths. In addition, it is also suited for solid-liquid mass transfer operations with other solids such as silica gel.

▶ What's Been Done—The first commercial contactor, mentioned above, was built for one of the largest American chemical companies. Constructed from 20 ft. of 1-in. glass pipe, this unit is sufficiently flexible to make possible the study and

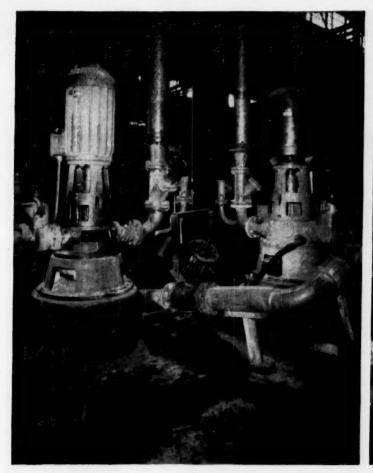
demonstration of a great variety of ion-exchange applications. From this unit, the user can scale up to pilot plant for large operations or directly to production for smaller operations.

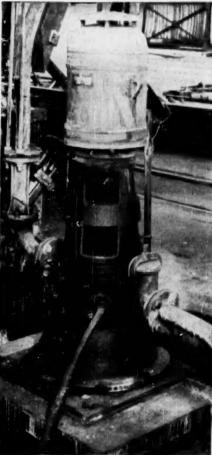
Previous work with the Higgins contactor, under A.E.C. sponsorship, has been carried out by Union Carbide Nuclear Co. at Oak Ridge National Laboratory. Dow Chemical Co. also has been working with the contactor under license. Both Dow and Oak Ridge built their own equipment.

► Bigger Ones Coming—Present technology permits construction of a wide range of unit sizes. These run from small laboratory-scale columns to plant-scale equipment 20 ft. high and 3 ft. in dia, Liquid flow rates may run as high as 2,000 gal./hr./sq. ft.

Standard mechanical components are used in construction of these contactors. In the words of Mr. I. R. Higgins, . . . trouble-free, long-life operation can be relied upon."

Moves Stepwise -Within the contactor, two sta-





"Almost No Maintenance" Since 1947

Back in 1947, Canadian Copper Refiners Limited installed a Type G LaBour packingless pump to handle electrolyte at their Montreal East refinery. Performance has been completely satisfactory, says the plant management, with almost no maintenance. In 1955 this company installed three more Type G LaBours and reports "similar satisfactory performance" from the newer units.

This experience is typical of many. Chemical men who have had LaBour pumps actually work-

ing for some time are best informed, and they usually insist on LaBours when it comes to expansion or replacement of older equipment. These men know that true economy in pumping comes only from dependable, day-in day-out service—the kind of service for which LaBour Pumps are recognized all over the world.

If you've had no direct experience yourself with LaBour pumps, we urge you to consult those who have. We'll be glad to help you.

LABOUR



Equipment Cost Indexes, p. 186

Processing Equipment

Continuous	Ion	Ex	ch	an	100	ei	r.			 				 			184A
Wet Screen			. ,														188A
Nuclear Pu	rifie	r .								. ,			,		. ,		188E
Grinding P	lot I	Plan	nt.									*					188C
Continuous	Con	tac	tor	٠,					 ,	. ,		,					188D
Continuous	Mix	er					× 8				*					*	188E

Heating & Cooling Equipment

Kiln Cooler																			196A
Heat Exchanger			*			,				*					*			*	196B
Bleach Coolers .																			
Heating Tape			,					*			*					*		*	196D
Heat Exchangers		,		*			*		×	ĸ	*			è		*			196E

Fluids Handling Equipment

Polyethylene	e Pip	e												 		×		,			190A
Piug Valve								*			,	,				*					190B
Propellers							,		×			*				*			×		190C
Corrosion-R	esiste	in	t	I	B	in	8							. ,							192A
Pinch Valve										*											192B
Fan Inlet D	ampe	r.																			192C
Titanium V.	alve																			×	192D

Instruments & Controls

Hygrometer										. 19	8A
Tank Selector System.											
Regulator Indicator								*		.19	8C
Pneumatic Transmitter											
Mass Spectrometer							*		8	.19	8E

Materials of Construction

Molded 1	Insula	at	io	n		,			ж.	į											194A
Tank Li	nings				 è		*			*	ĺ,	,	,								194B
Wire Cl	oth .									×		į									194C
Stair Tr	ead .								Ü					ì					Ī	í	194D
Insulated	Par	10	ı																		194E

Electrical & Mechanical Equipment

Gearmotor .							8		*		*				*	*	×		.200A
Power Unit			,														,		.200B
Pillow Block																	ì		.200C
Motor Protec																			
Induction Mo																			



For more details, use Reader Service Card

tionary dense beds of resin are separated by a valve midway up the column (see sketch). Resin is loaded in the top bed and is stripped in the lower one.

Rising beside the column is a leg which is connected to the top and bottom of the column to form a complete loop for circulation of resin. A pump connected to this leg provides hydraulic surges at regular intervals to move the resin in stepwise fashion around the loop.

Three Steps in Cycle—The three steps indicated by the sketches are controlled through a sequential timer and valving arrangement.

In the first step, the pump is inoperative and the valves are arranged so that feed and eluant streams are flowing through the two resin beds. After several minutes, the timer shuts off liquid flow into the column for a 3-5-sec. interval and changes the resin control valves as indicated in the second sketch.

The pump operates to move liquid in the column as shown by the arrows. The sudden application of pressure drop across the two beds causes them to slip in the column much like a piston in a cylinder. In-

Equipment Cost Indexes

Dec. March

	1956	1957
Industry		
Avg. of all	218.3	222.2
Process Industries		
Cement mfg	208.6	213.1
Chemical	218.8	223.3
Clay products	202.6	207.0
Glass mfg	206.7	210.9
Paint mfg	210.5	214.8
Paper mfg		215.2
Petroleum ind	214.9	219.3
Rubber ind	217.6	222.1
Process ind. avg	216.2	220.7
Related Industries		
Elec. power equip	220.8	225.6
Mining, milling	220.2	224.7
Refrigerating	245.9	250.9
Steam power	206.1	210.3

Compiled quarterly by Marshall and Stevens, Inc. of Ill., Chicago, for 47 different industries. See Chem. Eng., Nov. 1947, pp. 124–6 for method of obtaining index numbers; March 1957, pp. 266–7 for annual averages since 1913.

dividual particles maintain closely their relative positions within column.

In the final step, liquid streams once more are fed to the column while the pump piston returns to its original position. The slug of loaded resin which was moved from the top of the loading bed during the second step is dropped into the return leg by the return stroke of the piston.

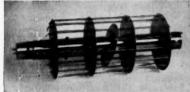
► Around and Around—You can see that the loaded resin which enters the return leg on one cycle will be forced around into the stripping bed the next time that the resin beds are shifted. Gradually with subsequent cycles, it advances up through the stripping section to pass finally through the resin-control valve into the loading section.

In this fashion, the ion-exchange resin is alternately loaded and stripped. Only the 5-sec. pause to move the resin every few minutes interrupts the essentially continuous contacting of resin with feed and eluant streams. Resin flow rate can be controlled accurately

Now! For the first time

intimately blend any liquid, regardless of viscosity, into dry solids-in one fast step-even up to 40% liquid volume by weight





VERSATILE. This wire cage assembly gives you three blenders in one. With it you can blend liquids into solids, or obtain dry intensive mixing action. Remove it and get gentle blending.



TYPICAL EXAMPLE. Bur breaks down agglomerates in material at left and prevents new agglomeration as liquid is added. Note uniform consistency in finished blend at right.



ABSOLUTE UNIFORMITY. Laboratory smear test reveals streaks where standard blending methods are used (left). With P-K's exclusive design, complete blending is assured (right).

These results can be proved in your own lab with a P-K Laboratory Model Liquid-Solids* Blender. 8 or 16 qt. capacity available from stock for instant delivery.

Scale-ups from lab tests are equalled or bettered in P-K production models with capacities from 1 to 50 cubic feet. This is a completely new concept in liquid-solids blending -exclusive with P-K.

Write now for Bulletins 15A on lab units, 7-15-A on production units of P-K liquid-solids blenders. The Patterson-Kelley Co., Inc., 167 Hanson Street, East Stroudsburg, Pa.

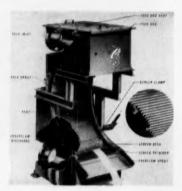


P-K Twin Shell Blenders* • Heat Exchangers
Packaged Pilot Plants • P-K Lever-Lock Doors*

*Patents pending

and it is handled gently with negligible attrition.

Small contactors will be manufactured by Chemical Separations Corp. Arrangements are now underway for the Illinois Water Treatment Co. to manufacture large equipment. Chemical Separations Corp., P.O. Box 149, Oak Ridge, Tenn. 184A



Wet Screen

Stationary design performs better than vibrating type.

Both capacity and efficiency of the Dorr-Oliver DSM screen are claimed to be far greater than those of vibrating screens. This new stationary screen is particularly adaptable to separations in the 8 to 48 mesh range. To date, it has worked successfully on a wide range of materials.

Basically, the DSM screen is a concave, horizontal-wedge-bar type of screen mounted in a stationary housing. Incoming slurry is distributed across the full width of the screen so that it strikes the curved surface tangentially.

As the flurry flows by gravity across the concave arc, a layer of slurry is deflected downward at each opening carrying undersize with it. By the time the material reaches the bottom of screen only oversize remains.

There are four standard sizes ranging from 1 to 4 ft. width. Capacity is approximately 200 gpm./ft. of width when making a 48-mesh separation and as high as 500 gpm./ft. of width when producing an 8-mesh separation. — Dorr-Oliver, Inc., Barry Pl., Stamford, Conn. 188A

Nuclear Purifier

Disposable type lowers purification cost.

Cost of removing dangerous radioactivity is reduced through use of the model XP15 disposable ion exchange nuclear purifier. Unit may be used for cation exchange, anion exchange or mixed-bed demineralizing. Also, it may be used with granular activiated carbon to filter and to absorb organic impurities.

Contaminated water is passed through the nuclear purifier so that radioactive ions from the solution are exchanged onto the resin bed for non-radioactive ions from the resin. The solution that leaves the purifier is essentially free from radioactivity. — The Permutit Co., 330 West 42nd St., New York 36, N. Y.

Grinding Pilot Plant

Handles experimental or custom grinding jobs.

Sturtevant Mill Co. announces that a Micronizer pilot plant is now operating. Four fluid-energy mills will handle experimental and custom fine grinding. Classification covers sizes ranging from 20 microns to smaller than one micron.

Capacity of the mills in the pilot plant ranges from ½ to 2,000 lb./hr. or more. Experimental grinding will be offered at the cost of set-up and labor. Custom grinding bids will be offered upon request.—Sturtevant Mill Co., 103 Clayton St., Boston 22, Mass. 188C

Continuous Contactor

Horizontal type overcomes channeling troubles.

Designed for large-scale extraction, a new continuous horizontal contactor features unique, slow-speed agitation. Unit may be used also for leaching, ion-exchange, decolorizing, deodorizing, crystallizing, washing and flotation exchange operations.

Basic vessel in the contactor

is a horizontal trough which can be covered, sealed and/or jacketed for heating and cooling. Any number of these troughs can be connected in series to obtain any desired solid-liquid contact time.

Paddles attached to a rotating shaft running down the center of each trough convey and tumble the solids simultaneously. At the discharge end a scoop pushes the solids out and into a take-away conveyor. Either liquid or solids can be added or removed at selected points in the unit.—Gifford-Wood Co., Hudson, N. Y. 188D



Continuous Mixer

Disintegrates or disperses small agglomerates.

You can avoid agglomerated balls or pellets in mixtures of dry or semi-dry materials by combining the components into a uniform mixture with the Turbulizer high-speed continuous mixer, it is said.

Not only does the Turbulizer mix uniformly but it can produce a fluffing action on dry powders. Also, it will disperse from 10 to 30% liquid into dry solids within a short time. But basically the machine finishes mixtures from other types of mixers or blenders.

Unit is self-cleaning with over-lapping adjustable paddles that run close to the stationary walls of the mixing chamber. The paddles adjust to control the flow rate through the machine.

Furnished as either a stationary or portable unit, the Turbulizer is priced low. — The Strong-Scott Mfg. Co., Minneapolis 13, Minn. 188E

How to cut costs with Crane valves



30,660 operations on tough corrosive and not a penny for maintenance

This case history may give you an idea how to save money in your own plant.

The man above is operating Crane 1inch diaphragm valves on lines to a railroad car washer, used by a mid-western railroad in its Los Angeles yards.

These are Crane No. 1631 valves with neoprene diaphragm and disc insert, and with 18-8 SMo bodies. Handling an acidic cleaning solution, these valves have been operated 12 times a day, 365 days a year for over 7 years. Yet despite the corrosive fluid, despite the long periods of frequent operation, none of these Crane valves has leaked . . . none has had a diaphragm rupture . . . none has required a penny's worth of maintenance.

This is another example of how Crane research and product design help industry avoid costly valve maintenance. For information on any valve application, call in your Crane Representative.



YOU'LL WANT THIS Crane Folder AD-1942 on packless diaphragm valves. Ask your Crane Representative for a copy, or write to Crane Co. at address below.

CRANE VALVES & FITTINGS

PIPE . PLUMBING . KITCHENS . HEATING . AIR CONDITIONING

Since 1855-Crane Co., General Offices: Chicago 5, Ill. Branches and Wholesalers Serving All Areas

New Polyethylene Pipe Handles Tougher Jobs

- 1. Boiling low-pressure water without irradiating pipe.
- 2. Solvents and hydrocarbons for long periods of service.
- 3. Almost all chemicals without losing strength,
- 4. Pressures from 75 to 150 lb. at room temperature.

Simultaneously with Allied Chemical & Dye Corp.'s announcement that a new form of low-pressure polyethylene is in commercial production, Orangeburg Mfg. Co. reports that it is producing plastic pipe from the new material.

What makes these twin announcements important to industrial users are the substantially improved performance traits reported for the new pipe. Orangeburg says that its new SP plastic pipe made with Allied's polyethylene exhibits properties superior to those of any polyethylene pipe yet produced.

Among these it lists higher bursting strength, resistance to impact, absence of stress cracking, superior heat resistance and resistance to chemicals, organic solvents and hydrocarbons.

▶ Better Quality, Wider Service —Improved properties offered in the Orangeburg pipe are attributed to the high molecular weight (over 750,000) and structure of the polyethylene molecule. These new qualities, and particularly the absence of stress cracking, are expected to greatly expand acceptance of plastic pipe for water service and industrial applications.

Tests have indicated that the pipe will be suitable for transmission of liquids encountered in oil and gas fields, a use denied to conventional polyethylene pipe. Here, there is a growing need for a flexible, tough pipe, resistant to the corrosive conditions which attack steel pipe.

► More From Same Size—Because of the improved physical properties, Orangeburg SP plastic pipe, made to iron-pipe size dimensions, can be recommended for substantially higher working

temperatures and pressures than pipe made from conventional polyethylene resins.

To substantiate claims made for this pipe, production runs were subjected to exhaustive long-term laboratory and field tests. Results far exceeded standards prescribed by the industry. It is significant to note that slit failure, or pin-holing, could not be induced in any of the samples on any of the tests. ► Use in Field-While stronger than conventional polyethylene pipe, SP plastic pipe is less flexible. However, it is sufficiently flexible to permit easy laying in the field and will come in coil lengths up to 400 ft.

No special tools are needed for installation. It cuts readily with a hacksaw and can be joined readily using fittings, together with a steel clamp and screwdriver. Hot welding techniques also have been developed.

P What to Look For—SP plastic pipe is available in ½ through 2 in. sizes and carries the National Sanitation Foundation approval for potable water service. Compared with other polyethylene pipes, Orangeburg SP will cost less than 100-lb. pipe, will compete with 75-lb. pipe and will be slightly higher than Standard Wall.—Orangeburg Mfg. Co., Orangeburg, N. Y. 190A

Plug Valve

Has Teflon sleeve to eliminate lubrication.

A new line of stainless-steel plug valves incorporating Teflon sleeves is recommended for liquid and gaseous corrosives, solvent and slurry services. Also, it's suited for hydraulic and pneumatic services where standard valves will not seat because of mechanical interference from entrained solids, polymerization, crystalline deposits or heavy slurries.

The low-friction Teflon sleeve permits plug to turn freely under all operating conditions. An unusual design feature is the internal ribbed construction which locks the sleeve in position. Then, at high pressure, sealing is continuous around body ports and bore, yet permits sleeve to expand and contract without leakage.

Valves are furnished in a range of sizes from ½ through 2 in. screwed end and ½ through 2 in. flanged end.—Continental Mfg. Co., 247 Park Ave., New York 17, N. Y. 190B

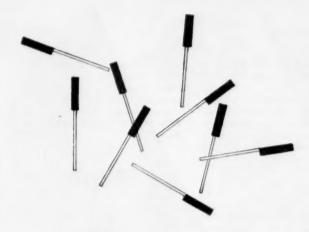
Propellers

Improved for cooling towers and heat exchangers.

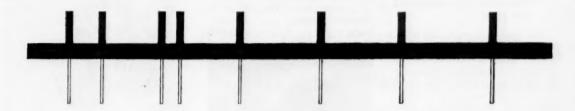
New Al-Metal propellers are reported to be a unique modification of the Macheta airfoil propeller.

Propeller blades, cast of aluminum, are engineered to move maximum volumes of air per unit of power consumed. These blades are balanced individually so that they may be interchanged in any assembly. Blade root fits snugly into socket. Peripheral key on root engages keyway in socket to provide maximum strength.

Available with 4 or 6 blades in diameters from 14 to 18 ft., these units offer single or multiple-pitch operation. Angle settings for each operating requirement, with appropriate alternate settings, assure accurate pitch for any predetermined performance.—Aerovent Fan Co., Inc., 700 East Ash St., Piqua, Ohio. 190C



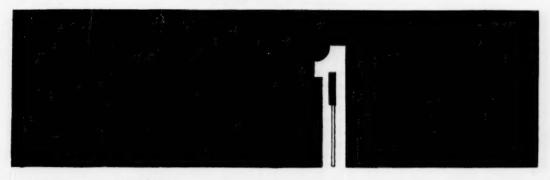
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Corrosion-Proof Fans

Fabricated of resin-bonded fiber glass.

For the most severely corrosive air-handling jobs, industry now is offered an improved, corrosion-resistant, impact-resistant fume fan constructed of resin-bonded fiber glass. It withstands a wide range of corrosives up to 225 F.

These new type FG fans are more versatile, lighter and reliable at reasonable cost. The fiber-glass fan housing has molded-in stainless-steel studs for attachment to the bearing stand. This feature protects the studs from contact with the air stream. The balanced-steel rotor wheel is protected by thick fiber glass on all exposed surfaces.

Type FG fume fans are available in standard capacities up to 34,000 cfm. at static pressures to 10 in. of water.—Buffalo Forge Co., Buffalo, N. Y.

Pinch Valve

Has new operating mechanism that closes fast.

An outstanding feature of new models of the Massco-Grigsby pinch valve is the Hydral-Air operating mechanism which closes the valve rapidly and easily.

Consisting of an air-hydraulic pump, this operating mechanism can be installed as a centralized unit that operates several valves. Also, it can be equipped for automatic regulation where it is essential to control liquid level in tanks or the rate of flow in pipe lines.

Other new-type operating mechanisms include a torquearm reducer for manual operation and a motorized unit. When valves are installed on remote locations, any of the three types of mechanisms can be controlled remotely.

Valve with either rubber or neoprene sleeves from 1 to 14 in. I.D. can be furnished for pressures to 150 psi, and temperatures to 200 F. A patented feature of this valve is the channel molded into opposite interior sidewalls of the sleeve to act as hinges when the sleeve is compressed.—The Mine & Smelter Supply Co., Denver, Colo.



Fan Inlet Damper

Controls air volume and pressure.

Volume and pressure of air delivered by airfoil centrifugal fans is controlled by a new variable inlet vane damper that fits into the fan housing. Acting as a manual or automatic output control, the damper greatly reduces power consumption and cuts operating costs to a minimum.

Damper has nine pie-shaped metal vanes. Mounted in an aerodynamic inlet cone, they adjust from 0° pitch when fully closed to 90° pitch when entirely open. When set at the desired pitch, the metal vanes spin the entering air in the same direction as the fan blades are moving.

Fans now in service can be fitted with the new damper by removing the original inlet cone and substituting a new inlet cone with the self-contained vane. Damper is available for fans from 12 through 80% in. dia.—Chicago Blower Corp., 9863 Pacific Ave., Franklin Pk., III.



Titanium Valve

Stronger, lighter and more corrosion-resistant.

Fabrication of the first titanium valve culminates $2\frac{1}{2}$ yr. of intensive research by the Fabri-Valve Co. of America. Despite present high cost, these valves will find wide use in pulp and paper mills, chemical plants, oil refineries and nuclear reactors predicts Fabri-Valve Co.

Valve is stronger, lighter and more corrosion-resistant than a stainless-steel valve. The 6-in. DiFab wedge-gate valve stands about 24-in. high and weighs 60 lb., which is 40 lb. less than a comparable steel valve.—Fabri-Valve Co. of America, Portland, Ore. 192D







*The "Tri-Sure" Trademark is a mark of reliability backed by over 35 years serving industry. It tells your customers that genuine Tri-Sure Flanges (inserted with genuine Tri-Sure dies), Plugs and Seals have been used. IN packaging and shipping the iron-free grade of ethylene glycol, Jefferson Chemical Company, Inc., of Houston, faced the problem of contamination from the metal of the closure.

a Perfect Seal

About a year ago, conversion was made to *Tri-Sure* Polyethylene Plugs*. Since that time, the contents of all drums tested after shipment have been found to be of the same high quality as when packaged.

More and more chemical and petroleum companies are equipping their drums with Tri-Sure Closures, because experience has proved to them that *Tri-Sure* offers a solution to every problem of protection.

You can depend on the interengaging Tri-Sure Flange, Plug and Seal for safety from leakage, seepage and tampering. And for extra protection in lined containers, Tri-Sure offers many specialized fittings—polyethylene, coated and polygonal.

Send for details or ask your supplier about the complete Tri-Sure line—the best solution to your closure problem.

AMERICAN FLANGE & MANUFACTURING CO. INC., 30 ROCKEFELLER PLAZA, NEW YORK 20, N.Y. CHICAGO, ILL. - LINDEN, N. J. - NILES, OHIO

The Sign of .

Tri-Sure Products Limited, St. Catharines, Ontario, Canada
Tri-Sure S/A Indéstria e Comércio, Sao Paulo, Brazil
American Flonge & Manufacturing Co, Inc., Villawood, N. S. W., Australia
Compania Mexicana Tri-Sure S/A, Avenida No. 1 y Piramide, Naucalpan, E. de Mexico, Mexico
B. Van Leer N. V., Stadhouderskade 6, Amsterdam, Holland
Van Leer Industries, Ltd., Seymour House, 17 Waterloo Place, Pall Mall S. W. I, London, England



Molded Insulation

In pipe or block form for use to 1,200 F.

New Thermasil molded pipe and block insulation is strong, light, hard, chemically stable, non-flammable and is not affected by water or excessive water vapor. Thermal conductivity ranges from 0.31 at 100 F. to 0.51 at 600 F., Btu./(sq. ft.) (hr.) (°F./in.). Density is 12 lb./cu. ft. max.

Thermasil material is a hydrous calcium silicate compound blended with other selected inorganic ingredients which are reinforced with long asbestos fibers.

For pipes, the insulation is available to fit all sizes up to 18 in. Simplified thickness standards make it possible for every pipe size and wall thickness to fit precisely over or inside another pipe size.

Block insulation is supplied in 18 or 36-in. lengths with thicknesses of 1 or 1½ in. for 6-in. wide blocks, and with thicknesses of 1½, 2, 2½, and 3 in. for 6 or 12-in. widths.—Ehret Magnesia Mfg. Co., Valley Forge, Pa. 194A

Tank Linings

Convert worthless old tanks into usable systems.

By using newly developed techniques, Haveg is converting worthless old tanks into usable systems. To date, tanks up to 55-ft. dia., have been lined.

Tanks are lined in the field by molding or cementing resin linings of asbestos-filled phenolic or furan, graphite-filled epoxy and glass-reinforced polyester. Savings are substantial because the cost of a usable tank is less, need for razing the original is eliminated and, where tanks are inside buildings, there is no need to make changes in the building structure to permit entry or removal of large tanks.

An additional advantage is the elimination of welding in or around tanks that may contain residual fumes.— Haveg Industries, Inc., 900 Greenbank Rd., Wilmington 8, Del. 194B

Wire Cloth

Now woven from corrosionresistant titanium.

Corrosion-resistant titanium wire cloth now is being manufactured on a production basis. It is finding applications in filtering assemblies, catalysts, screens and other equipment. In the pulp and paper industry, titanium is showing excellent resistance to bleaches.

Because weaving requires wire with good elongation and uniformity of temper, the purest and most ductile grade of standard mill product titanium is used. Present production includes 30×30 mesh made of 0.016 wire and 10×10 mesh with 0.035 wire.—Cambridge Wire Cloth Co., Cambridge, Md.

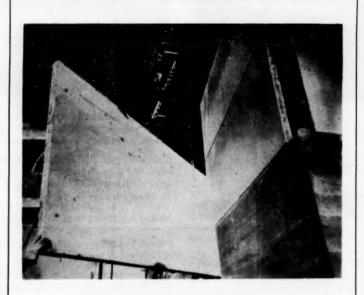
Stair Tread

Die cast from aluminum with slip-proof feature.

A precision-cast aluminum stair tread just placed on the market combines safer footing for industrial workers with long-term maintenance savings for plant managers.

Cast in one piece, the tread utilizes a special aluminum alloy to insure high corrosion resistance and strength and to afford long maintenance-free life. A nosing of Alcoa abrasive tread plate provides non-skid qualities.

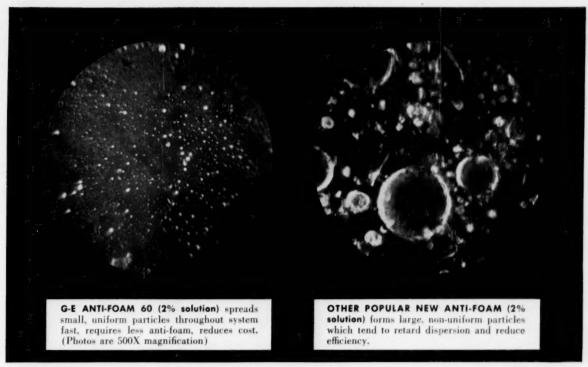
Sizes now available range from 24 to 42 in. long with standard 10-in. width.—Aluminum Co. of America, 1501 Alcoa Bldg., Pittsburgh 19, Pa.



Paper Mill Gains Flexibility With Low-Cost Panel

Concrete-cellular-glass panel is swung into place at Irving Pulp & Paper's St. John (N. B.) plant. If equipment must be moved in or out of building at a later date, panels can be removed temporarily to allow entry. Consisting of 2-in. layer of

Foamglas insulation sandwiched between 2-in. slabs of concrete, panels saved \$162,000 over conventional construction on total area of 180,000 sq. ft.—Pittsburgh Corning Corp., One Gateway Center, Pittsburgh 22, Pa.



Micro-photographs show why . . .

G-E silicone Anti-foam 60 disperses faster, controls foam more economically

Rapid dispersion of small, uniform particles of antifoam material is the key to fast, low-cost foam control. Here the performance of General Electric silicone Anti-foam 60 is outstanding. Anti-foam 60 disperses almost instantly into minute, uniform particles that destroy foam bubbles fast.

And with G-E Anti-foam 60 you get maximum benefit from silicone's inherent foam-destroying action, and get it more economically because only a few parts per million are needed in most foaming systems.

If defoaming can reduce your processing and filling time, eliminate costly boil-overs or increase your batch capacity (in aqueous systems), get a free test sample of General Electric Anti-foam 60 by mailing the coupon below. We think you will find, as many

Mail this coupon for a free test sample:

Progress Is Our Most Important Product

GENERAL 🍪 ELECTRIC

Silicone Products Dept. Waterford, New York others have, that Anti-foam 60 is the most economical answer to your problems.

For non-aqueous systems—

G-E silicone fluids and compounds are also available for efficient low-cost defoaming of non-aqueous systems. Ask for free samples of SS-66 or SF-96.

SS-66 is a low-viscosity silicone anti-foam compound. Typical uses include defoaming during esterification of vegetable oils—as well as in paints, inks, antibiotic fermentation and phenolic resin cooking.

SF-96 fluids are available in standard viscosities from 40 to 100,000 centistokes for defoaming all hydrocarbons from light-end gasolines to heavy-end asphalts.

	one Products Department Company, Waterford, New York
Please send me o	sample of G-E Anti-foam
Application	
Application	Position
	Position
Name	Position



Kiln Cooler

Rotates with kiln, cools fine particles.

A tube-type cooler, long used by the Warner Co. in the production of lime, is now being manufactured by Allis Chalmers. Design is particularly good for cooling fine and soft materials because there is no tumbling action or violent contact with the air stream to cause dust losses.

Cooler consists of a series of tubes, 3 to 5 ft. dia. and 15 to 20 ft. long, which are attached along the kiln shell at the discharge end. Within each tube is a series of spiral baffles which convey the material and transfer heat from the solids to counterflowing air.

Hot kiln product enters the tubes, filling them about half-way. Air enters from the cool uphill end. As the material is moved uphill with the rotation of the kiln and attached cooler tubes, it gives up its heat to the baffles. They, in turn, give up the heat to the downflowing air.—Allis-Chalmers Mfg. Co., Milwaukee 1, Wis.

Heat Exchanger

Wide range of standard sizes for ordinary needs.

Exceptionally high performance at low cost is reported for the new Hi-Transfer line of heat exchangers. These units are offered in a wide range of standard sizes which fill all ordinary requirements.

Hi-Transfer exchangers are designed to assure maximum heat transfer with minimum pressure drop. Shell and tubes are made for working pressures of 75 lb. and are tested at 115 lb. All parts and exchanger units are completely interchangeable to permit fast, easy installation and servicing. Also, parts are readily accessible to facilitate maintenance.—Whitlock Mfg. Co., West Hartford, Conn.

Bleach Coolers

Standard line in all sizes and capacities.

Now available for standard batch or continuous manufacture of sodium hypochlorite bleach is a standard line of coolers. Long service has proved these units to be completely free from chemical attack.

Construction of these Camac bleach coolers features graphite heat transfer tubes and polyvinyl chloride connections. There are no cemented joints since all fabricating cements normally used for assembling graphite are attacked rapidly by hypochlorite.

Coolers can be provided with or without a plastic circulating pump. They also can be furnished complete with refrigeration compressor and chiller or fitted for cooling water operation.—Carl Buck & Associates, Essex Fells, N. J. 196C

Heating Tape

Utilizes silicone to resist many environments.

Need for more flexible and wear-resistant electric heating tapes that also may be fabricated into blankets has led to development of a new silicone rubber tape. It has great resistance to wear, organic solvents and outdoor exposure.

Basically, the tapes are fabricated of finely stranded resistance wires insulated with braided fiber-glass yarns and knitted into flat tapes. This tape is then embedded completely in silicone rubber.

Temperature limit for these

tapes is 450 F. At present, they are available in 1-in. widths and unlimited lengths. Tapes in 2 and 4-in. widths are contemplated for the near future.—Briscoe Mfg. Co., 1055 Gibbard Ave., Columbus 3, Ohio. 196D



Heat Exchangers

Complete standard line for rapid delivery.

A complete standard line of single and double-pass heat exchangers is now available for delivery within two weeks from Pfaudler Co. Flexibility of the line allows you to satisfy most heat exchanger needs without requiring special or complicated designs, yet still meet ASME and TEMA codes.

Off-the-shelf units are available with two-week delivery from prestocked stainless-steel exchangers in sizes ranging from 56 to 316 sq. ft. Other sizes up to 20-in. shell diameter are assembled on a 4-6 week delivery basis from a large stock of "flexible standards" including tubing, shells, bases, nozzles, etc.—The Pfaudler Co., 1036 West Ave., Rochester, N. Y.

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Hygrometer

Sensitive model for panel mounting.

A new panel-mounted electrolytic hygrometer automatically and continuously measures water concentrations in vapor samples. Accuracy is within 5% in the difficult 0-1,000 ppm. range at temperatures up to 100 C.

Instrument is valuable for controlling corrosion, product purity and process efficiency. Moisture is determined by passing the sample gas stream through a special analytical element that absorbs and electrolyzes all moisture present in the stream. The current required for this electrolysis is a precise measurement of the amount of water present.

An alarm system incorporated in the instrument can be set for any point in the instrument's range. A standard recorder or recorder controller can be operated from the hygrometer output to make possible continuous monitoring of water vapor in a plant process stream. — Process Instruments Div., Beckman Instruments, Inc., 2500 Fullerton Rd., Fullerton, Calif. 198A

Tank Selector System

Controls filling of process and storage tanks.

Reduced costs are promised for controlling the filling of storage and settling tanks with the new automatic tank selector system. System is said to be extremely accurate, reliable and economical.

Using a pneumatic circuit, selector-controller and level transmitters in the ATS system direct operation of the pneumatic fill valves. Liquid level in each tank is sensed. If filling is needed, the fill valve is opened automatically. If not, the scanning operation proceeds to the next tank.

Each ATS system can handle up to 12 tanks. Since there is a minimum of equipment, cost is low. — Mason-Neilan, Div. of Worthington Corp., 60 Nahatan St., Norwood, Mass. 198B

Regulator Indicator

Warns when process temperature deviates.

Industrial processes and hotwater systems can be checked accurately as well as controlled automatically by the No. 11 indicating, self-operating regulator.

While the regulator itself governs temperature automatically, a unique front-mounted dial thermometer provides continuous temperature readings of the process under control. Because the thermometer is mounted in front, the regulator can be installed in tight spaces. Also, there is less chance of damage to the indicator.—Powers Regulator Co., 3434 Oakton St., Skokie, Ill. 198C

Transmitters

New design allows stepless changing of range.

First of a new family of instruments, Republic's new pressure and differential-pressure transmitters are especially valuable where operating ranges may change. They are applicable to all flow, pressure or differential-pressure transmitting jobs requiring accuracy and sensitivity.

Design of these instruments is based on a "null-balancevector" principle which permits greater compactness, reduces weight and provides for stepless change of range with a simple screw-driver adjustment. The latter is done by changing the angle at which input forces are applied to the linkage, thereby altering the component of such forces that must be balanced.

Standard models of both instruments operate on 20 psi. air to produce output signals from 3 to 15 psi.—Republic Flow Meters Co., 2240 Driversey Pkwy., Chicago 47, Ill. 198D



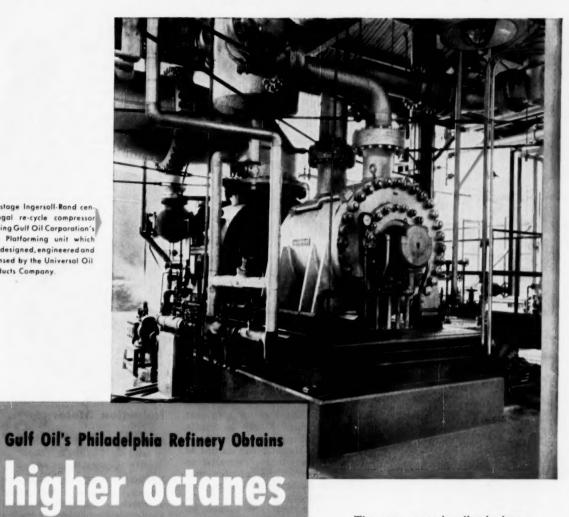
Mass Spectrometer

Analyzes precisely in plant or field.

A new, inexpensive, portable mass spectrometer for analyzing small amounts of gaseous mixtures or liquids that are capable of being vaporized has been placed on the market. The over-all mass range of the instrument is from 2 to 80 with resolving power adequate for separation of adjacent peaks up to about mass 35.

Mass numbers appear linearly and equally spaced along a fixed time base on a large, motor driven dial — making mass marking unnecessary. A metal rotary valve makes batch sample introduction a simple, routine operation.

Errors in settings cannot damage the instrument. It weighs only 115 lbs and is suitable for bench, rack or trailer mounting, with the analyzer and control modules either stacked or separated.—Consolidated Electrodynamics Corp., 300 North Sierra Madre Villa, Pasadena, Calif. 198E



Six-stage Ingersolf-Rand centrifugal re-cycle compressor serving Gulf Oil Corporation's new Platforming unit which was designed, engineered and licensed by the Universal Oil Products Company.

with modern Ingersoll-Rand Centrifugal Compressor

N THE new Platformer for producing high octane gasoline at Gulf Oil's Philadelphia refinery, large volumes of low-density hydrocarbon gas are compressed. To do this big job, an advanced-design Ingersoll-Rand sixstage re-cycle centrifugal compressor has been installed.

The compressor handles hydrogen gas being re-cycled to the reaction section. It has a capacity of 2780-cfm, operates at 8300-rpm and is driven by a 3000-hp steam turbine. This advancedesign centrifugal compressor is of the barrel or double-case construction, with a forged steel outer casing. The removable inner or liner casing is vertically split to facilitate inspection and rotor removal. Pressurized oil-shaft seals are provided.

I-R compressors are supplied in types and sizes to meet all refinery requirements. To help work out the best answer to meet your needs, see your nearest I-R engineer.



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Gearmotor

Space-saving, right-angle type for heavy duty.

New Reliance gearmotors are available with features such as horizontal or vertical mountings, conventional double shaft and hollow shaft to fit all types of reduced-speed applications.

In one to ten horsepower sizes, these motors are rated for continuous duty; one to 30 horsepower for intermittent

A pair of helical gears provide primary reduction and a patented double-enveloping worm gear set handles the secondary reduction. Double-enveloping feature of the worm gear set gives constant double-throated contact over a 45-deg. sector of the gear wheel.

This means smaller gears produce the necessary ratings, saving space and weight. Also, it produces lower output speeds at higher efficiencies than conventional gearmotors. — Reliance Electric & Engineering Co., 24701 Euclid Ave., Cleveland 17, Ohio.

Power Unit

Converts a.c. motors to variable speeds.

Using the new Varidyne power unit, you can convert any standard NEMA 3-phase a.c. induction motor to a variable-speed drive without even removing it from its present installation.

Speed of the standard a.c. motor can be varied by changing the frequency of the power driving it. That's what the Varidyne power unit does.

Frequency of the current delivered to the motor by the Varidyne power unit can be varied at will merely by adjusting a handwheel at the power unit. Or it can be done remotely by mechanical or electrical controls.

Varidyne power units are available to handle a total connected load from 1 to 50 hp. with speed variations up to 5 to 1. More than one induction motor can be connected to the same power unit. If they are the same rating, they will change speeds equally and simultaneously.—U. S. Electrical Motors, Inc., Box 2158 Terminal Annex, Los Angeles 54, Calif.

200T

Pillow Block

Incorporates unique mounting feature.

The new Spher-Align line of spherical roller bearing pillow blocks incorporates the Micro-Mount mounting feature. With this feature, the user can seat the bearings solidly on shafts and do it quickly and easily.

Micro-Mount relies on use of set screws located parallel to the bore in the adapter nut. After the bearing is snugged up with the adapter nut, the Micro-Mount screws are turned up against the locking washer until bearing, adapter and shaft form an integral unit.

Another feature of this design allows lubricant to enter at the center of the bearing and move outwardly along all bearing surfaces. Offered in both expansion and non-expansion types, bearings are stocked in sizes to fit shafts from 2½ to 8-in. dia.—Dodge Mfg. Corp., Mishawaka, Ind.

Motor Protector

Cuts power to motor when it becomes overloaded.

Any three-phase, induction motor can be protected against failure due to shaft overload, voltage unbalance and/or single phasing by the prompt action of the type TS motor-protecting relay.

Device employs the basic principles of symmetrical components to drop out any motor that approaches dangerous overheating from one or a combination of the three faults named above. Each unit is custom built to extremely close tolerances to meet the nameplate data of the motor for which it is intended. Relay is available in any of the standard NEMA type enclosures. — The Electrical Service Co., Ardis Hgts., Greenville, Tex.



Induction Motors

Built to new standards in 40 to 125 hp. sizes.

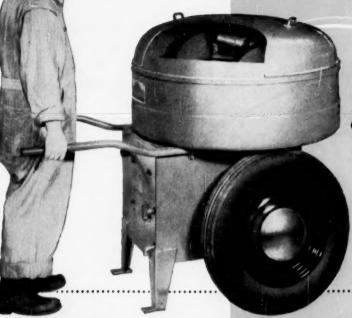
With introduction of its new line of 40 to 125 hp. induction motors, General Electric Co. becomes the first manufacturer to complete redesign of its entire standard line of induction motors from one to 125 hp. in accordance with the new NEMA standards.

Compared with the former line, the new motors weigh an average 20% less. Lineal dimensions average 10% less and volume 27% less. These reductions result largely from improved insulation.

Included in the new Tri-Clad 55 line, frame sizes 364U through 445U, are complete selections of both open-drip-proof and totally enclosed fan-cooled.

Open-drip-proof motors have more of the one-piece cast-iron frame enclosed than formerly. Therefore, these motors can be used many places where splash-proof motors were needed formerly. The totally enclosed, fan-cooled model has maximum protection against chemical and other corrosive atmospheres.—General Electric Co., Schenectady 5, N. Y. 200E

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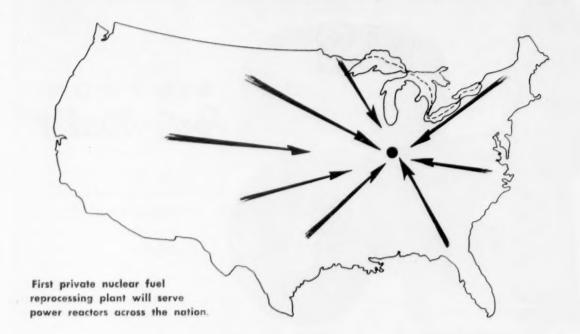
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CHEMICAL ECONOMICS EDITED BY D. R. CANNON



Look for Nuclear Fuel Reprocessing by '65

Frank R. Bruce, Oak Ridge National Laboratory, Oak Ridge, Tenn.*

I F A backlog of experience in power reactor fuel recovery existed, it would be a simple matter to arrive at a fair processing charge. In the absence of such experience perhaps the best approach is to examine allowable recycle costs and assign a fair fraction to chemical processing.

First let's make some assumptions: that nuclear electric power will sell for 8 mills/kwh.; that the class of power reactor with a capital investment of \$250/kw. of installed electrical capacity, and which operates at an irradiation level of 4,000 megawatt days heat/metric ton of uranium, seems most likely to make the grade in the next ten years.

Based on these assumptions the total fuel recycle cost cannot exceed \$17/kg. of uranium. Since the fuel recycle includes fuel fabrication, shipping and storage, as well as fuel processing, it is likely that the processing charge should not exceed \$8/kg. of uranium, or about 0.4 mill/kwh. of electricity.

Chemical processing costs are most sensitive to plant throughput, with lower unit costs being associated with higher throughputs. Accordingly, the earliest date when it will be possible to build a spent fuel processing plant, and to operate it with an economically acceptable charge, will be determined by the growth of the nuclear power industry.

▶ How Big Will the Job Be?—We'll use McKinney Panel estimates of this growth and assume that the average power reactor will convert heat to electricity with 25% efficiency and irradiate fuel to a level of 4,000 mwd./ton of uranium. The daily reprocessing capacity required may be calculated and is shown in Fig. 2.

There is expected to be about

4,000 mw. of nuclear heat capacity installed by 1962, requiring about 1 metric ton of uranium/day of reprocessing capacity. By 1970 about 15 tons of uranium/day of chemical processing capacity will be required.

Military reactor demands have not been included in this study, and would have to be added to the preceding.

Because of the expected rapid growth of the nuclear power industry the constructor of a spent fuel processing plant is faced with a difficult problem in sizing up his installation.

For example, a plant sized for the nuclear industry of 1965 will be fourfold too small to handle fuel anticipated in 1970, twelvefold too small to handle the load expected in 1975.

► What Will it Cost? — Let's look now at the capital investment required for spent fuel reprocessing, and how the unit

^{*} Meet your author on p. 317.



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TRIMETHYLOLPROPANE BECOMES A COMMERCIAL CHEMICAL THROUGH CELANESE ALDOL PRODUCTION

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Trimethylolpropane was severely limited.

New aldol processing units at the Celanese Chemcel Plant in Bishop, Texas, are now turning out commercial quantities of Trimethylolpropane -making available to manufacturers a product possessing low water content, low melting characteristics, and exceptionally high purity.

The development of Trimethylolpropane into

a commercially practical chemical is an example of how Celanese research and product development teams are finding new ways to give industry what it needs in more productive basic and intermediate materials.

Celanese Corporation of America, Chemical Division, Dept. 553-G, 180 Madison Avenue, New York 16, N.Y. Celanese 8

Basic reasons.....

Acids Alcohols Aldehydes Anhydrides Functional Fluids Gasoline Additives Giycols Ketones

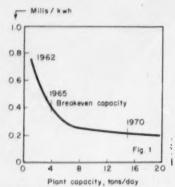
Polyola Plasticizers Salts Solvents



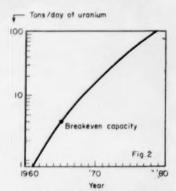
..... for improved products

Agricultural, automotive, aviation, building, electrical, paper, pharmaceutical, plastics, surface coatings, textiles.

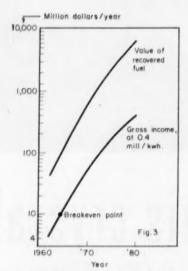
1965: First Chance for Profit in Nuclear Fuel Recovery



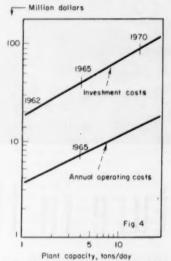
RECOVERY COST VS. CAPACITY Allowable reprocessed fuel rates fix breakeven point.



REPROCESSING LOAD VS. TIME Breakeven capacity fixes time of first central unit.



GROSS INCOME VS. CAPACITY Fuel recovery plant won't show much profit for awhile.



PROCESS COST BREAKDOWN Unit costs fall off fast as output picks up.

recovery cost decreases with increasing processing rate.

Fig. 4 shows the estimated relationship between reprocessing plant capacity and required capital investment for chemical plants capable of processing the diversified power reactor fuels to 2% enriched uranium.

Since the estimates are based on conceptual design studies, and not on actual experience, their accuracy may not be too great. It's significant, however, that capital investments of roughly \$19 million, \$40 million and \$80 million will be required to service the nuclear power industry of 1962, 1965 and 1970, respectively.

Operating costs for hypothetical power reactor fuel reprocessing are also shown in Fig. 4, as a function of capacity.

Solvent extraction plants require an operating force whose numbers are relatively insensitive to plant size. Unit recovery costs decrease with increasing plant size. Again, these figures are not based on actual experience and accordingly are subject to error.

Fig. 1 presents expected fuel decontamination costs obtained from the data of Fig. 4, as a function of plant capacity.

If the premise that fuel recovery should be accomplished at a cost of 0.4 mill/kwh. is accepted, then it is clear that a 4-ton/day plant is required. Sufficient fuel to keep this plant on stream 100% of the time would become available in 1965 (Fig. 2).

It should be noted that this conclusion makes no allowance for costs incurred in fuel shipping and storage, fuel inventory, plant downtime—or for profit.

Gross income from the power reactor fuel reprocessing business—assuming the fuel processor can charge 0.4 mill/kwh. for his service—will be \$4.2 million in 1962, will have reached \$400 million by 1980 (Fig. 3).

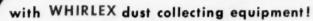
Value of fuel recovered by the processor in 1962 will be \$43 million; in 1980, \$6 billion.

Since no allowance has been made for military reactor fuel, it's probably safe to say that the spent fuel processor is entitled to a fair profit based on a gross income at least as large as those shown here.

▶ Centralize First—We expect economical spent fuel recovery will be accomplished, for many years to come, in central processing plants serving wide areas of nuclear power activity. This concept is essential to attaining chemical processing charges compatible with economic nuclear power.

Therefore, a preliminary study has been made of the optimum site for the first reprocess-





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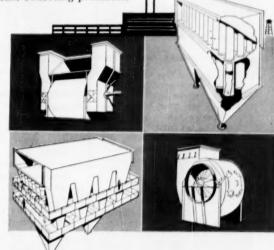
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Cost Comparisons of Spent Fuel Processes*

Alloying Agent and Cladding	Solvent	Solvent Extraction Column Diameter (In.)	Volume of Evaporated Waste (Gal./Kg. U)	Cost (\$/Kg. U)
Zirconium	Aqueous HF Anhydrous HCI	17	5.1	28 10
Stainless steel,	Aqueous H ₂ SO ₄ Dilute aqua regia	14	2.2	17

[&]quot;Based on recovery of 1 metric ton uranium/day.

ing plant. Factors which enter into locating this first plant are: costs of shipping fuel elements from reactors to the chemical plant; costs of cooling wastes at the plant; and, finally, the cost of shipping wastes for disposal.

In the study it was assumed that nuclear reactors would be constructed in those areas where rate of total power growth is greatest and where cost of conventional power is highest.

Our study shows the optimum location for the first central reprocessing plant to be near Indianapolis, Ind. Selection of this site was heavily influenced by the Chicago area's power demands. If military reactor fuel requirements were also considered, the plant location would be displaced toward the East.

Two avenues may be taken to the problem of spent fuel recovery; aqueous processing and nonaqueous processing. Aqueous processing converts the fuel to a nitrate solution from which heavy elements may be recovered by tributyl phosphate extraction. Nonaqueous processes include fluoride volatility and a wide variety of pyrometallurgical schemes.

Outstanding advantages of solvent extraction include ability to: yield completely decontaminated products; recover uranium, plutonium and thorium; and process all fuel elements which somehow may be converted to a nitrate solution.

The fluoride volatility process also yields completely decontaminated products, and is potentially simpler than solvent extraction. It's not yet developed, however, to the point where it can handle plutonium and thorium.

Pyrometallurgical processes are intrinsically the simplest and most economical, but yield incompletely decontaminated products which require remote fuel element fabrication. And they are not sufficiently well developed to possess the versatility of solvent extraction and fluoride volatility.

▶ Best Process Bets—Thus we conclude that the latter two processes will play the most important part in spent power reactor fuel recovery for many years.

Early fuel recovery plants must be capable of processing a wide variety of fuels containing zirconium and stainless steel as diluents or cladding. Early approaches to the problem included zirconium solution in aqueous hydrofluoric acid, and stainless steel solution in sulfuric acid. They may not, however, be economical because of severe corrosion and the large volumes of wastes produced in the processing.

New approaches to the problem include separation of uranium from zirconium by volatilization of the latter as zirconium tetrachloride, and solution of stainless steel in dilute aqua regia

These developments promise substantial cost reductions over the older processes (see chart.)—mainly because of the smaller volume of feed solution which must be extracted, and the smaller volumes of waste to be stored.

But they pose many difficult problems which must be resolved. Thus they, and other attractive techniques, can only be used as a basis for plant design after they have been pilot planted and their engineering feasibility established beyond a doubt.

Chemical Consumption



Consumption by Industries

	Feb.	March
	(Final)	(Est.)
Coal products	10.7	12.1
Explosives	9.7	10 2
Fertilizer	72.1	76.5
Glass	24.7	25.8
Iron & steel	18.3	19.4
Leather	4.2	4.3
Paint & varnish	27.1	31.5
Petroleum refining	29.1	32.4
Plastics	22.8	24.0
Pulp & paper	34.8	38.1
Rayon	26.8	28.3
Rubber	6.9	7.3
Textiles	9.7	10.1
		-
Total	298	320

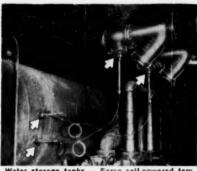
No one has yet built a nuclear reactor specifically for generating power.

Thus Mr. Bruce's remarks on reactor fuel reprocessing must be speculative—as remarks must be on many aspects of nuclear electricity.

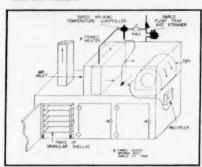
But these are educated speculations and point unerringly to this fact: Chemical recovery of spent fuel is not around the corner.

Bruce tells why. Optimum plant size isn't clear; complete plant site data aren't available; good methods haven't been developed to handle all types of fuel and process wastes; a stiff capital outlay is required.

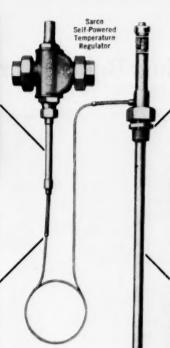
This article evolved from a paper delivered by Bruce at the Fifth Atomic Energy in Industry Conference in Philadelphia last March.



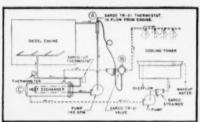
Water storage tanks — Sarco self-powered temperature controls on service water storage tanks from twin heaters.



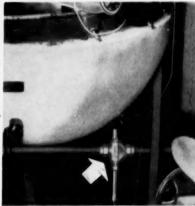
Shellac dryer — even temperature maintained; moisture uniformity of granular shellac accurately controlled — by Sarco self-powered temperature control.



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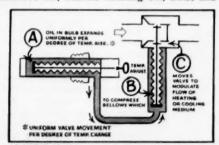
Steam-jacketed kettle — desired temperature of kettle content is automatically maintained by Sarco self-powered temperature control. Steam waste, uncertainty of manual control eliminated.

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Chemical Spending: Bullish Through '60

CAPITAL OUTLAYS hit record levels . . .

(Millions of dollars)

			% Change			
	1956°	1957	1956-57	1958	1959	1960
Chemicals	1,455	1,906	+31	1,849	1,720	1,651
Pulp & paper	801	985	+23	887	692	692
Petroleum refining	711	924	+30	979	910	746
Rubber	201	217	+ 8	228	242	223
Stone, clay & glass	686	633	- 8	508	493	455
All manufacturing	12,787	14,452	+14	12,390	11,057	10,601

^{*}U. S. Dept. of Commerce, Securities and Exchange Commission, McGraw-Hill Dept. of Economics.

To create new capacity . . .

(Index of industrial capacity, 1950 = 100)

				% Increase		
	1956	1957	1960	1956-57	1957-60	
Chemicals	163	178	217	9	22	
Pulp & paper	142	151	177	6	17	
Petroleum refining	132	137	152	4	11	
Rubber	145	152	172	5	13	
Stone, day & glass	136	143	160	5 .	12	
All manufacturing	142	151	174	6	15	

^{*}Weighted by 1947-49 value (added weights used by Faderal Reserve Board in the calculation of the industrial production index).

To buy research and development . . .

Millions of d	ollars)		
1955	1956	1957	1960
441	498	528	617
36	43	48	58
171	205	225	277
66	73	82	95
46	59	66	81
4,514	5,786	6,972	8,850
4,767	6,097	7,319	9,269
	1955 441 36 171 66 46 4,514	441 498 36 43 171 205 66 73 46 59 4,514 5,786	1955 1956 1957 441 498 528 36 43 48 171 205 225 66 73 82 46 59 66 4,514 5,786 6,972

^{*}Source of base statistics (1953): National Science Foundation.

To meet demands for products . . . especially the new ones.

	% Sale	Increase	New Products,* % of Sales
	1956-57	1957-60	1960
Chemicals	7	25	16
Pulp & paper	8	22	9
Petroleum refining	6	13	2
Rubber	5	14	5
Stone, day & glass	4	19	8
All manufacturing	6	19	10

^{*}Products not produced in 1936 or products sufficiently changed to be reasonably considered as new products.

Top spenders in manufacturing this year, chemical makers plan to keep pouring it on.

William H. Chartener, McGraw-Hill Dept. of Economics

Chemicals will top all manufacturing industries this year in expenditures on new plants and equipment. Chemical companies now plan to spend \$1.9 billion in 1957, or 31% more than last year's record-breaking outlay.

Beyond 1957, they already plan to put more in capital spending in each of the years 1958, 1959 and 1960 than they did in 1956. And about two-thirds of their total outlays over the next four years will be for expansion, rather than modernization and replacement of existing facilities—an incredible record of growth for 5-6 yr.

Chemical processors as a whole plan to boost expenditures by 21% this year, to a new high of over \$4.6 billion. Projected increase for all manufacturing is only 14%; for all U. S. business, only 12%.

Engineer-Scientist Needs—So finds the tenth annual McGraw-Hill survey of business' plans for new plants and equipment. This year, in addition to querying industry on capacity, sales outlook, research and development and new products, McGraw-Hill asked firms how many engineers and scientists they would need to carry out their research programs this year and in 1960.

Hefty increases budgeted for research and development over the coming four years threaten to pinch still tighter the supply of trained scientists and engineers. In all manufacturing the expected increase in scientist-engineer employment for research and development is 7% this year and another 15% by 1960.

Chemical companies estimated they would need 5% more in 1957, another 16% by 1960. Petroleum refiners put their



Two **Eimco Burwell Filters** recover and wash uranium precipitate before it goes to a rotary dryer in an acid leach flowsheet that produces yellow cake (magnesium ammonium diurinate).

Uranium rich eluate is precipitated with magnesium oxide and ammonia in a 20,000 gallon batch operation and pumped to settling tanks. Clear supernatent is decanted to waste and pulp is pumped to the 2" x 26", 10 - frame Eimco Burwells at 50 psi.

In this critical assignment, the Eimco-Burwells recover precipitate in a very short cycle time (1 hour, 15 minutes, start to start). During the cycle, precipitate is washed to specification in 20 minutes. Filtrate losses are less than 15 ppm.

The homogeneous split cakes formed on these Eimco-Burwells provide this firm with a high flow rate during the entire cycle because effective filtrate area is not seriously reduced as filling progresses.

This cake formation also eliminates channeling and short circuiting.

Washing occurs through half a cake thickness... permits maximum removal of soluble values with a minimum wash volume.

One set of frames is filtering while the other is cleaning; thus, cleaning downtime is negligible. High mechanical operating efficiency of frames and filters sharply reduce labor, maintenance and filter medium costs.

Eimco vacuum and pressure filters provide users operating and production advantages in many phases of uranium flowsheets as well as in a wide variety of other chemical and metallurgical processes.

Write today for detailed information or arrange to have an Eimco field engineer help you with your process problems.

THE EIMCO CORPORATION

Research and Development Division, Palatine, Illinois

Process Engineers Inc. Division, San Malea, California
Expert Offices: Einste Building, 51-52 South Street, New York 5, N. Y.

BRANCHES AND DEALERS IN PRINCIPAL CITIES THROUGHOUT THE WORLD



Wanted: Scientific Manpower

%	Increase	in Needs*
	1956-57	1957-60
Chemicals	5	16
Pulp & paper	7	17
Petroleum refining	9	22
Rubber	2	6
Stone, clay & glass	8	15
All manufacturing.	7	15

^{*} For research & development.

needs at 9% more this year, another 22% by 1960. (See above.) ► Chemicals Keep Driving — Tight money, a squeeze on profits and threats of overcapacity have clearly not fazed chemical companies. In fact, the expected increase of 31% in capital spending this year shows they have added to the plans reported to McGraw-Hill last fall, when they said they would spend only 29% more than in 1956.

All the chemical process industries, except stone, clay and glass, expect to increase spending on new plants and equipment this year. Pulp and paper producers plan to top last year's spending by 23%. (In the fall they predicted only a 21% rise.) Rubber producers plan an 8% increase this year, followed by further boosts in 1958 and 1959.

Petroleum refiners are not so ambitious as they were last fall when they reported they would spend 50% more this year. But they still envision a snappy 30% rise in 1957 and another increase next year. Stone, clay and glass firms are cutting their spending 8% this year, expect a further decline in 1958.

In all cases figures for years beyond this one are preliminary

Sales Outlooks Prod Capacity

	% Increase, 1957-60*		
	Sales	Capacity	
Chemicals	25	22	
Pulp & paper	22	17	
Petroleum refining	13	11	
Rubber	14	13	
Stone, clay & glass	19	12	
All manufacturing	19	15	

[&]quot;In terms of physical volume.

plans, plans which typically are broadened-but sometimes are cut-as actual spending looms. ► Spending to Grow—Huge capital spending programs over the past half-dozen years are showing up in greatly increased capacity. By the end of this year the CPI will have 51% more production capacity than at the end of 1950. And by the end of 1960, capacity will have been increased almost 75% over the 10-year span.

Chemical companies alone expect to have 78% more capacity by the end of this year than in 1950, with a 9% hike since 1956. By 1960 they will have more than double their 1950 capacity.

Expansion plans are going ahead despite the fact that many chemical lines are operating several notches below present capacity. Chemical companies reported to McGraw-Hill that they were operating at 83% of capacity at the end of 1956-as against a preferred capacity, on the average, of 92%.

Three other process industries, incidentally, were operating above their preferred rates at the end of last year: pulp and paper, petroleum refining, and the stone, clay and glass group. The rubber industry was operating slightly below its preferred rate.

► Glowing Sales Prospects—Behind the continued surge of expansion in chemicals and the CPI is confidence over sales prospects. For all the CPI group the expected rise in sales is 19%, while spending plans call for only a 15% rise in capacity between 1957 and 1960. This year both capacity and sales are expected to increase 6%.

Chemical firms are betting heavily on new products in their sales forecasts and expansion plans. They estimate that in 1960 new products-products not produced in 1956 or products sufficiently change to be reasonably considered to be new products-will comprise 16% of their total sales. In manufacturing as a whole, only 10% of all 1960 sales are expected to be "new products."

Half the chemical firms said, furthermore, that a significant share of their 1957 capital expenditures would be for turning

out new products. Only the electrical machinery industry had a larger percentage of companies accenting new products.

Research Still Blossoms-Research and development spending has soared in the past year, promises to continue its spectacular climb through 1960. All U. S. industry spent \$6.1 billion on R&D last year, a 28% increase over 1955. Plans indicate another 20% rise this year.

McGraw-Hill's survey, which provides the only figures on R&D spending plans, reveals industry expects to spend almost \$9.3 billion on this creative function in 1960. At the current rate of increase, even this huge sum may be exceeded.

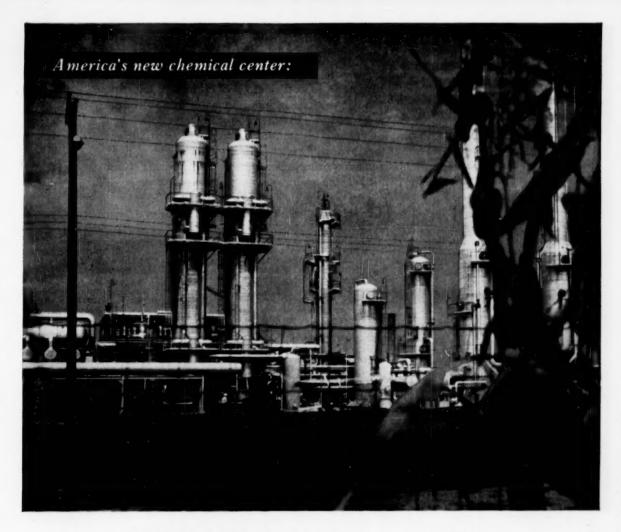
Research and development budgets in the research-conscious chemical process industries are not climbing as fast as in other industries where research is a new craze. In 1955, for instance, the CPI accounted for nearly one in every six dollars allocated to industrial research. But by 1960, according to present plans, less than one in every eight dollars will come from the CPI.

The rise in research expenditures in the CPI is, however, still an imposing trend, and one of vital importance to the future of these industries. Chemicals alone will spend over \$527 million on R&D this year and plan to spend \$617 million in 1960. The CPI group as a whole expects to spend just under \$950 million on R&D this year and \$1,128 million in 1960.

► Goals Within Reach - This year's stepup of 21% in capital spending comes after a year when CPI spending on new plants and equipment jumped 33.5%. But the increase should be attainable since both industrial capital markets and materials shortages have eased slightly since last fall. Besides, a third of this year's money increase will go merely to offset higher prices.

Last year only the chemical industry was able to carry out the volume of plans reported to McGraw-Hill in the spring of 1956. Its plans called for \$1,433 million; it actually spent \$1,455 million. The other four process

industries fell short.



\$75,000,000 plant in a cornfield supplies bulk chemicals from pipeline gases

Endless streams of chemicals for industry and agriculture pour from the \$75,000,000 plant built by National Petro-Chemicals in the cornfields at Tuscola, Illinois.

Together with associated U.S.I. plants in the same area, it forms a fully integrated chemical complex, able to supply long-term, bulk requirements from a convenient mid-continent location.

Approximately 500,000,000 cubic feet of pipeline gases daily are now processed to extract ethane, propane, butane and natural gasoline. Further processing produces ethylene, ethyl chloride, ethyl alcohol, ether and polyethylene. Other products can be made if demand arises.

Look to this new chemical center to supply your bulk petro-chemical needs.

NATIONAL PETRO-CHEMICALS

CORPORATION

A joint enterprise of National Distillers and Chemical Corporation and Panhandle Eastern Pipeline Company
99 PARK AVENUE, NEW YORK 16, N. Y.

Get the power of three for the price of one in the \$47-billion-a-year CPI* market

In the 1957 Chemical Engineering Inventory Issue all the events of this big year in the *chemical process industries are tied up in one powerful selling package. The three big sections include: Inventory of Chemical Engineering Awards; 26th Exposition and Chem Show; Inventory of Plants, Chemicals, Equipment. Each one is a potent sales tool in the CPI . . . now we're putting them all together, bringing them out at the height of your hottest selling season. It's an advertising opportunity you simply can't afford to miss. Check these bonus benefits against your own sales objectives!

26th Exposition and Chem Show

- Chemical Engineering's circulation (44,000 for this issue) closely parallels the Chem Show attendance.
- The Chem Show section of the 1957 Inventory Issue includes the listings from the actual program being distributed at the Show . . . plus maps of booth locations.
- Exhibitors who advertise anywhere in this issue get their names printed in boldface in the program listings, plus ½-inch space to print a short message.
- Readers of the Chem Show listings in the issue are referred to your ad for complete details.
- The program distributed at the show itself will reflect the same type (boldface listings, etc.) and will refer an estimated 60,000 visitors to your ad in CE's 1957 Inventory Issue for further information.
- The 44,000 circulation of the issue plus 60,000 distribution of the program at the show means a total exposure of 104,000 who will be referred to your ad.
- Low-cost insurance . . . protect your investment in booth, display and manpower by giving prospects full details on your exhibit, so they can schedule their itinerary accordingly.

Inventory of Plants, Chemicals, Equipment

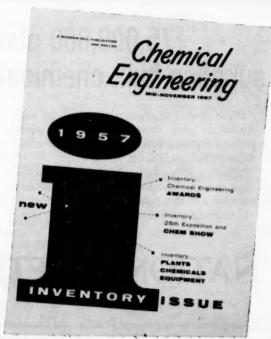
- Chemical Engineering's annual Inventory of Plants, Chemicals and Equipment is a unique service, providing the reader with information available nowhere else in the industry.
- 12-month life . . . Research shows that buyers keep the Inventory at hand all year, use it whenever they need information about raw materials, equipment, technical literature.
- Your ad will appear in the appropriate section so readers will see it whenever they are interested in your type of product.
- Psychological timing . . . when buyers see your ad in this issue, they are actively looking for information about new developments in the industry.
- 12-month reader service, too.
 Ads in the Inventory Issue are
 proven inquiry pullers every
 month of the year. The last three
 issues averaged 75,000 highquality inquiries apiece.

Inventory of Chemical Engineering Awards

- CE's Achievement Award is the most coveted honor in the industry. Naturally the award story draws high-interest readership throughout the CPI.
- This year the report will include not only a multi-page story on the 1957 winner, but individual coverage of past winners as well.
- Extra high interest, heavy readership is guaranteed among personnel of award-winning companies . . . many of whom are your prime prospects.

Add up all these advertiser advantages; try to find any other place in the industry where you can duplicate them. You just can't do it. Whether or not you're a Chem Show exhibitor, it's a unique opportunity to reach a maximum audience with high reader impact . . . through an industry service that guarantees a yearlong active life for your ad. Wire (collect) your space reservation today.

Published November 15, 1957
First Forms Close September 25
Last Forms Close October 10



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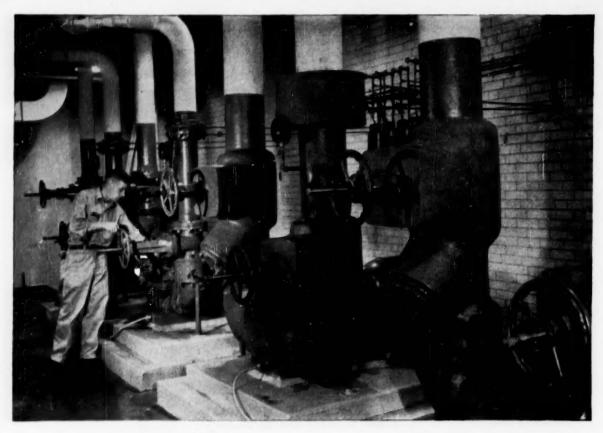
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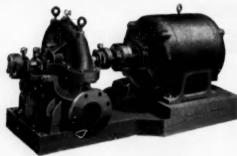
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"Buffalo" Type SL Double Suction Pump, industry's choice for clear water service in capacities from 10 to 14,000 gallons per minute.



Impeller and shaft assembly of "Buffalo" Type SL Pumps. Note precision ball bearings, busky shaft, wearing rings and efficient enclosed imbeller.

FOR PERMANENT PUMPING EFFICIENCY

Don't Leave Out the "Q" Factor*

"Buffalo" PUMPS like the Type SL Double Suction Pumps above, handling chilled water in a large plant, assure this permanent efficiency! Their design and construction go far beyond "good enough". Their ample water passages and well designed impellers — providing smooth hydraulic balance and efficiency — reflect the high standard of engineering, foundry and machining craftsmanship developed in our 80 years of building pumps. We call this standard the "Q" Factor*, and it's the reason behind the permanent pumping efficiency enjoyed by owners of "Buffalo" Pumps everywhere. Write for Bulletin 955 and see why you save by specifying the best!

*The "Q" Factor — the built-in Quality which provides trouble-free satisfaction and long life.

BUFFALO PUMPS

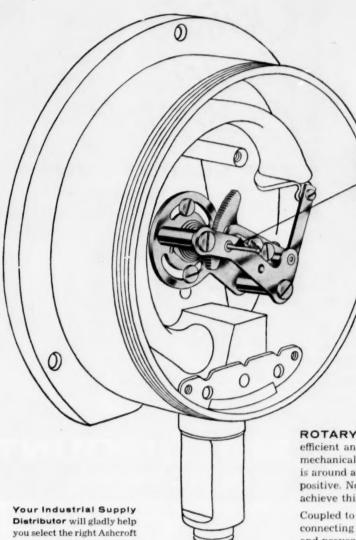
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A BETTER CENTRIFUGAL PUMP FOR EVERY LIQUID



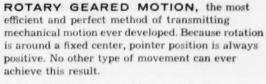
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Duragauges for your particular needs. You can always depend on him for prompt

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Coupled to the movement is a one-piece connecting link that guarantees correct calibration and prevents slippage or parting under tension. Accurate recalibration is easy from front or rear of the movement. Universal adjustability permits the use of uniformly graduated dials, thereby facilitating maintenance.

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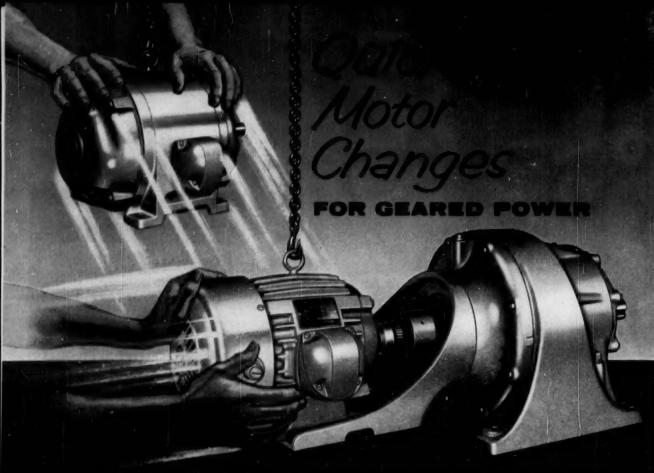
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New U.S. MOTOMOUNT

Designed to meet J.I.C. Specifications

In one compact power package a high-speed NEMA foot-mounted motor and a low-speed, double reduction gear transmission. Motor change in minutes! And with U.S. Motomount Syncrogear, the change is not limited to the type motor being replaced! If you carry a spare motor inventory, here is real flexibility and quick-change. U.S. Uniclosed, Totally-Enclosed, or Explosion-Proof motors of the same NEMA dimensions and ratings may be used to meet changing requirements. Available in h.p. ratings 1 to 30. U.S. Motomount Syncrogear has solid shank ever-tight pinion, friction-free oil seal, thru-hardened gearsmany advanced features for longest life.







MOUNTS LIKE AN INTEGRAL UNIT, FOR INHERENT ALIGNMENT ... Both units of the U.S. Motomount Syncrogear have rugged, pyramidal base construction -made-to-match pyramids to hold motor and mount aligned for life-factory alignment PLUS centralized responsibility for manufacture of both components.

CAST IRON FOR ALL EXTERNAL PARTS . . . For tough, industrial duty! Besides providing structural stability, cast iron protects against corrosive elements. All castings normalized for permanent retention of precision machining.

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it pays to take a

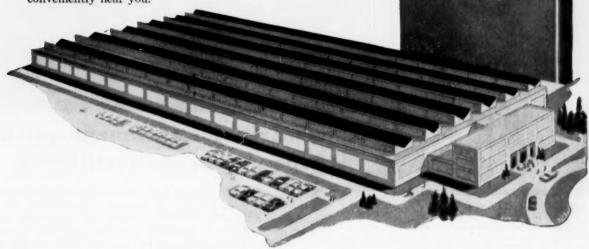
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which do you have...
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All industry is under pressure . . . to reduce costs . . . raise efficiency. And managements today see weighing in a new perspective—not as isolated scales, but as a vital element in the overall cost-control system. This means the right scales in the right places . . . to supply basic accounting records of materials received, processed, shipped, transferred.

Weight records directly affect costs, inventory control and customer billings. Weights must be right the *first* time. Whether discovered or not, weighing errors can lead to losses in profits and customer good will

To assist you with your "weight control" problems,
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the experience and services of factory-trained representatives
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NEW TOLEDO WEIGHT FACT KIT...
Shows you the job your scales are now doing! This new Toledo Weight Fact Kit will help you determine how well your scales measure up as a weighing system—show you if any scales are "misfits" in capacity, application or location—help you detect weighing inefficiencies that drain off profits.

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TOLEDO HEADQUARTERS FOR SCALES



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PAYLOADER *

does 100 manhour job in 30 minutes



SCARIFIER ATTACHMENT

consists of 4 husky teeth hinged on a bracket behind the bucket. Teeth dig only when bucket is lowered and machine travels in reverse - do not interfere with normal bucket operation . . . are quickly removable.

THE FRANK G. HOUGH CO.

754 Sunnyside Ave., Libertyville, Ill.

Send data on "PAYLOADER" tractor-shovels

☐ Model HA (18 cu. ft.) and HAH (1 cu. yd.)

☐ Larger models up to 21/4 cu. yd.

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Title

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City

New scarifier attachment quickly rips-up packed fertilizer

Removing the solidly-packed fertilizer that accumulates on concrete runways and floors usually is a laborious pick-and-shovel job. But now, the new Model HAH "PAYLOADER", with the scarifier attachment, can do the job in a fraction of the time and at very little cost. For example, at this fertilizer plant the Model HAH cleaned up an area in 30 minutes that formerly required 100 hours of hard, manual labor . . . much to the amazement and gratification of the plant management.

This is another example of how you get more and better performance from a "PAYLOADER". Standard operating features of the new, 1 cu. yd. Model HAH "PAYLOADER" include: 45° bucket roll-back at ground level; hydraulic load-shock-absorber; power-transfer differential; powerful breakout digging action; power-steering and hydraulic brakes. Ask your "PAYLOADER" Distributor to demonstrate what a Model HAH or other sizes will do for you. See him, or write us.

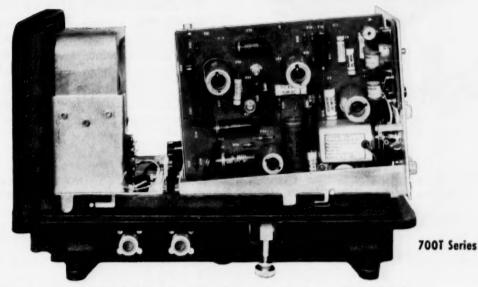


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Converts any primary electrical signal into a 3-15 psi pneumatic output for controllers and receivers.

The unit is continuously standardized automatically. It assures complete electronic balance and permits optimum response adjustments. There are no slide wires, no batteries, no moving parts.

Easy continuous adjustment of range span and zero suppression—exclusive Taylor vernier adjustment gives exceptionally fine accuracy in calibration of the unit. You can completely change the range and zero suppression as plant conditions demand—only need one instrument as a spare.

Quick, simple removal for service with minimum instrument down-time . . . means that checking can be done efficiently in the shop where full facilities are available.

Modern printed circuits insure uniform performance because there's no variation between units. Principal electrical components are identified by engraved numbers on the phenolic board—another simplification for the maintenance technician.

Quickly adapted for use for different primary elements because you just plug in the corresponding service "can". "Most ingenious . . . and most

practical"—that's what instrument men say about this important addition to the TRANSET* System.

That this ingenious instrument works so well in so many places is another reflection of the years of experience of Taylor instrument engineers in helping solve the problems of the processing industries.

Your Taylor Field Engineer can suggest where a Taylor Potentiometer Transmitter will help you in your processing picture. Write for Catalog 98262. Taylor Instrument Companies, Rochester, N. Y., and Toronto, Canada.

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Only LOAD LUGGER gives you these money-saving and safety features

THE LOAD LUGGER SYSTEM OF MATERIALS

HANDLING (detachable steel containers handled by a Load Lugger equipped truck) offers many new opportunities to reduce the cost of handling materials of all kinds. In addition, Load Lugger's simple, rugged design and construction give you easier, safer operation, lower maintenance costs, bigger pay loads, lower truck investment.

EASY OPERATION RIGHT FROM THE TRUCK CAB

Lifting, lowering, dumping the container, raising and lowering the stabilizers is done with three simple controls conveniently grouped in the truck cab. On cab-overengine trucks controls are outside the cab.

LOW-MAINTENANCE DESIGN AND CONSTRUCTION

Simple rugged hydraulic hoist mechanism has a minimum of moving parts. No complicated superstructure, rollers or track. Load Lugger simplicity means less maintenance, less down-time.

NO TRUCK FRAME REINFORCING NECESSARY

Proper weight distribution eliminates excessive weight on rear of truck and the need for expensive frame reinforcement and counterweights which reduce net pay load.

SAFE FOUR-POINT CONTAINER SUSPENSION

Two lifting chain lugs on each side of container are located above container's center of gravity. This Load Lugger safety feature prevents the container from flipping over completely while being dumped.

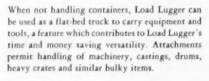
SAFE DUMPING

Load Lugger containers are tilt-type, the load being dumped from the end of the container rather than through the bottom. Complete control of the container and load is maintained throughout the entire dumping cycle. The integral container bottom also prevents leakage of liquids.

GREATER LEGAL PAY LOADS

No sacrifice in total net pay load weight as cubic content of container increases. In travel position, center of gravity of loaded container is abead of the rear axle of the truck. Result is better load distribution and ability to carry bigger pay loads without violating legal axle load limits.

UNOBSTRUCTED FLAT DECK



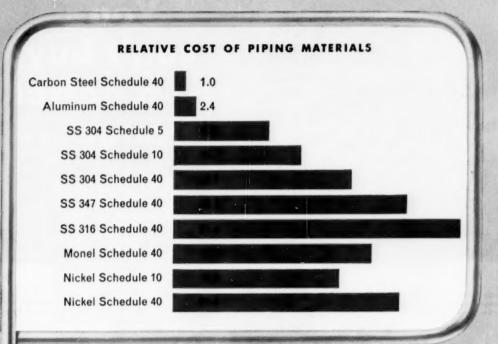
Feature for feature, you get more for your money when you invest in Load Lugger. Let us discuss your material handling problem with you and recommend the Load Lugger which will fit your needs.



LOAD LUGGER, Ingersoll KALAMAZOO DIVISION BORG-WARNER CORPORATION

1887 North Pitcher Street, Kalamazoo, Michigan, Telephone Fireside 5-3501 EXPORT SALES: BORG-WARNER INTERNATIONAL CORPORATION, CHICAGO

Here's the cost story on Reynolds Aluminum process pipe



... AND THAT'S ONLY THE FIRST SAVING

Users say aluminum process pipe is the most economical corrosion resistant pipe available.

THESE ARE THE REASONS:

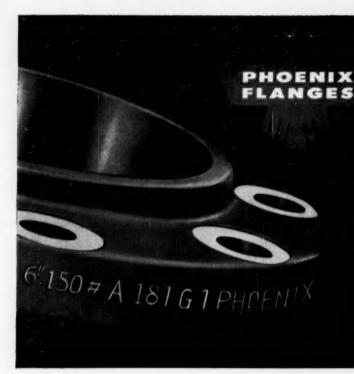
- · Aluminum costs less to buy.
- Aluminum costs less to install because of light weight and weldability.
- Aluminum resists corrosive effect of hydrogen peroxide, nitrogen solutions, many acids, alcohols, foods, sweet and sour crudes, raw or refined gases, kerosene, gasoline, napthas, and many other process liquids.
- Aluminum is non-sparking for greater safety to plant and personnel.
- Aluminum requires little maintenance has longer life.

Write for this important literature: "Corrosion Keys for Aluminum" and "Aluminum Process Pipe".

For more information on how you can save with Reynolds Aluminum Process Pipe, call the Reynolds office listed under "Aluminum" in classified telephone directories, or write Reynolds Metals Company, P.O. Box 1800-CJ, Louisville 1, Kentucky. International Division, 19 East 47th Street, New York, 17, N.Y.



See "CIRCUS BOY", Reynolds exciting dramatic series, Sundays, NBC-TV



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can't buy
a better
flange...



Forged Steel. Shot Blasted. All Phoenix flanges meet full A.S.A. specifications—earbon steel and alloy.



Special facings, bores, drilling, threading and special machining available.



Spot faced bolting surfaces, extra fine facings, accurate threading and a protective coating are typical of Phoenix quality.

Precisely machined welding bevel.

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Precision turned compression nut (A) slips over liquid tight conduit. Brass Ferrule (B) screws into conduit with sleeve covering conduit. Tightening compression nut onto connector body (C) provides a positive seal and ground between flexible conduit and connector.



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* APPLETON "ST" Series Connectors have an exclusive brass ferrule, and unique construction to make it your best connector buy for use with liquid tight flexible conduit! Nothing to come loose, deteriorate, crack or break. APPLETON "ST" Series Connectors stay tight . . . positively exclude liquids, fumes, chips, shavings and other foreign matter from electrical systems. Recommended by many electrical engineers. And, since the threaded brass ferrule screws in and crimps on there is a perfect seal and permanent ground . . . maintaining voltage in ground circuit unfailingly within 10 millivolts drop. "ST" Series Connectors are one more reason why APPLETON is . . .

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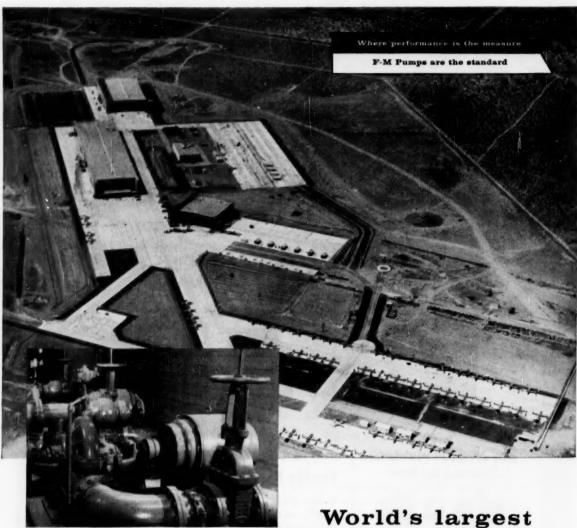


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CHEMICAL ENGINEERING-July 1957

225

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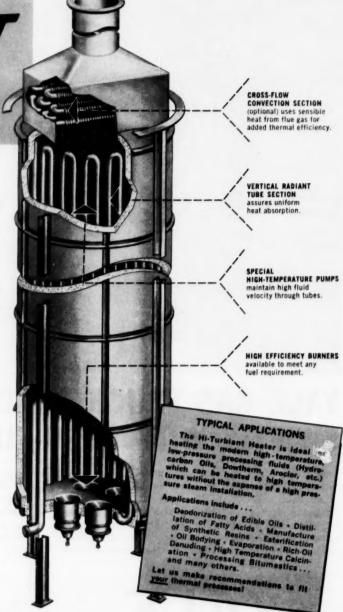
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The Hi-Turbiant Heater system is available in a complete range of sizes from 3 to 40 million BTU/hr-with or without a convection sectionto meet a wide variety of applications. If you plan process operations using heat-sensitive fluids, let our engineers explain the many advantages of Hi-Turbiant heating. No obligation, of course!





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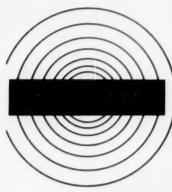
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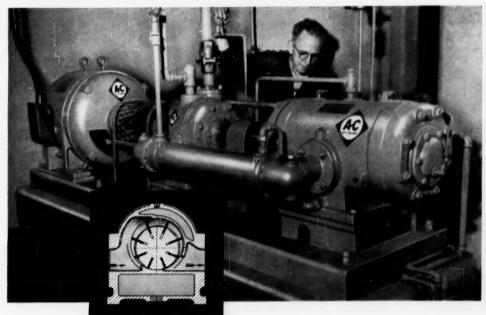
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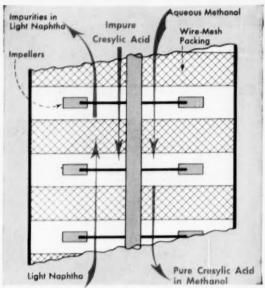
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PROCESS FLOWSHEET EDITED BY T. P. FORBATH





CONTINUOUS EXTRACTION is new cresylic AGITATED PACKED TOWER handles the job. process' key step. It replaces usual batch washing. Paddles, wire mesh contact feed with two solvents.

Cresylic Acid Refining Now Goes Continuous

DITT-CONSOL CHEMICAL CO. has plucked an early bloom from parent Pittsburgh Consolidation Coal's verdant coal-chemicals research garden.

The company has commercialized a completely continuous process for the manufacture of phenol, cresols and cresylic acids a process originally aimed at upgrading liquids from low-temperature coal carbonization. But with a commercial LTC plant still well over a year away, Pitt-Consol went into business, instead, with petroleum refinery wastes for its feedstock.

Process' key innovation is the continuous extraction of impurities with two countercurrent solvent streams. This step takes place in the agitated, packed tower shown above.

In full production since February, the \$3.5-million installation at Newark, N. J., produces 20 million lb./yr. of refined products. A 40-million-lb./yr. plant, planned for Cresap, W. Va., will handle the same sort of feed. ▶ LTC Tar & Refinery Waste— Moreover, stresses a company spokesman, both plants will continue to process petroleum refinery wastes even after the first LTC plant swings on stream. LTC liquids then will serve as supplemental feed.

Reason: Each feedstock splits into different and complementary products. For example, refinery wastes run high in ortho-cresol and low in xylenols; just the opposite is true of LTC tar. And the marketplace is eager for both. Newark produces some 15% phenol, 15% ortho-cresol, 30% meta-para-cresol and 40% mixed cresylic acids.

► On-Stream Switchover — The new continuous unit has tripled Pitt-Consol's output at the Newark plant. But it represents more than just an expansion. It has replaced entirely the veteran facility at the site, bought from Reilly Tar & Chemical in 1955, that formally ushered Pitt-Consol into the chemical business.

And the switchover from old

to new was managed without dropping a stitch. While Arthur G. McKee & Co. (Cleveland), builder of the plant, raised the gleaming towers, Pitt-Consol kept the red-brick buildings of the old unit humming at full capacity.

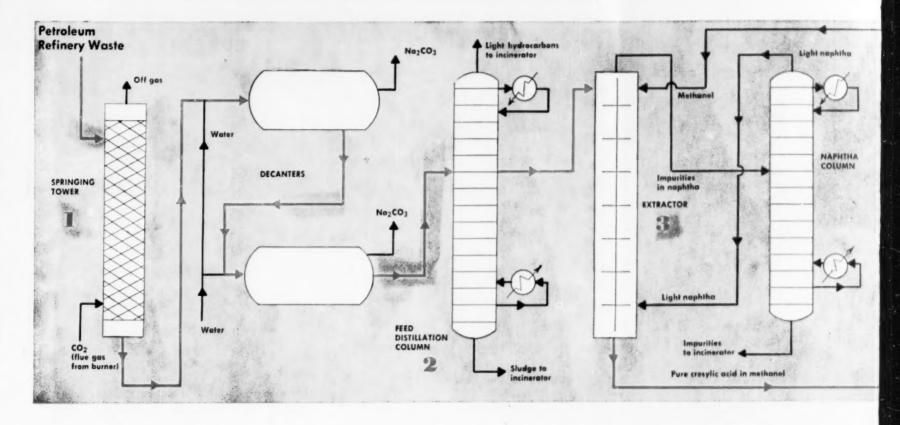
Aiming at Purity-The continuous extraction step was developed, in the first place, to handle the exceptionally high sulfur content of LTC tar. Its success is the chief reason that refinery wastes-also high in sulfur-are economically suited to the process as well.

This innovation, reports Pitt-Consol, slices sulfur content by nine-tenths. Furthermore, other impurities in the feed are reduced to negligible levels to make for all-around high product purities (see p. 174).

In replacing the batch caustic or lime washing stages of older cresylic acid routes, continuous extraction permits the first com-

Unfold Flowsheet





pletely continuous operation in this kind of processing. This gives close operational control, high uniformity of products and a compact installation.

► Place in the Run—Here's how the extraction step fits into the flowsheet:

Refinery wastes, consisting primarily of sodium cresylate, sulfur compounds (mercaptans) and hydrocarbons (e.g., neutral oil, gasoline) are reacted with CO₂. This "springing" operation produces sodium carbonate and cresylic acid (i.e., a mixture comprised primarily of phenol, cresols and xylenols). The liquid phases are then separated by decanting.

A preliminary distillation step splits out undesired light and heavy hydrocarbons. Heart cut goes to continuous extractor. There methanol dissolves cresylic acid, while light naphtha carries out all impurities. A final distillation separates the product fractions.

► Uniform Feed — Pitt-Consol gets its feedstock—spent caustic from washing cat-cracked gasoline—from 30 different petroleum refineries. Tar-acid contents range from 6 to 50%. To

provide a uniform feed, the wastes are stored and so blended in three 1-million-gal. tanks.

Feed goes to the top of the 60-ft.-high, 6-ft.-dia., Raschigring packed springing tower. Flue gas from an oil-fired burner, analyzing 8-14% CO₂, flows upward through the tower. Sodium carbonate precipitates out in a water-washing stage comprised of two series-hooked, 4,000-gal. decanters.

Preliminary fractionation of the "sprung" feed cuts out a 212-F. overhead of gasoline and a 450-F. bottoms of tar and sludge in a 35-ft.-tall by 3-ft.dia. bubble-cap distillation column. Heart cut then feeds to the extraction stage.

Paddles and Packing — A shaft fitted with impellers and driven by an electric motor runs vertically through the 60-ft.-high, 3-ft.-dia., Scheibel-type extractor. Wire mesh packing fits between the impellers, and together they provide intimate contacting of the three liquid streams.

Aqueous methanol flows down the tower; light naphtha flows up. Crude cresylic acid stream feeds cocurrently with the methanol. Methanol carries out, in solution, pure cresylic acid from the bottom of the tower. Impurities go into solution in the naphtha stream leaving at the top.

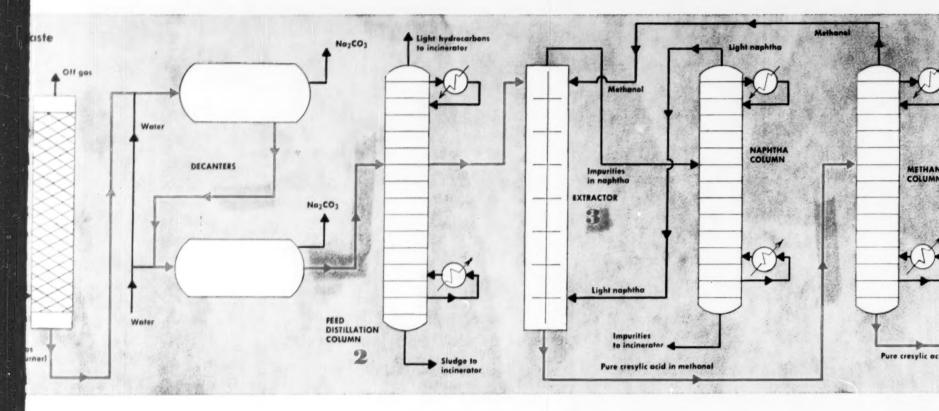
Both naphtha and methanol recycle for reuse from a pair of bubble-cap distillation columns that split the respective streams. Impurities from the naphtha tower are incinerated. Pure cresylic acid from the methanol tower moves on to a drying stage. There acid is decanted from residual water in an 8,000-gal. tank, further dried via distillation in a small packed column.

➤ Cracking Out Product—Fractionation of cresylic acid into product fractions takes place in four 3-ft.-dia. bubble-cap distillation columns ranging in height from 60 to 75 ft. First three towers run continuously and yield marketed products. The fourth operates on a batch basis; it provides Pitt-Consol with a chance to custom tailor special blends.

Pitt-Consol sends all products to a tank farm where specific blending can be carried out before shipment.



SPRINGING: CO, frees cresylic acid from so cresylate in 60-ft.-high, Raschig-ring-packed to



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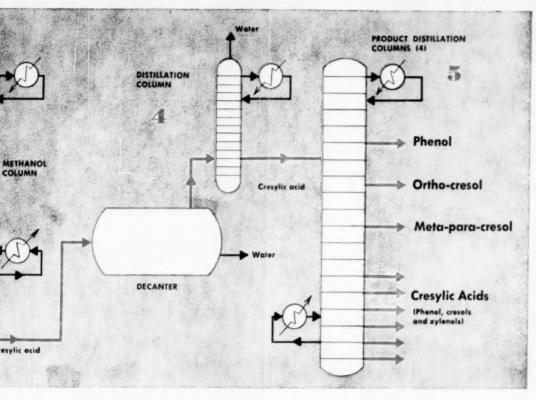
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SPRINGING: CO, frees cresylic acid from sodium cresylate in 60-ft.-high, Raschig-ring-packed tower.



2 FEED PREPA





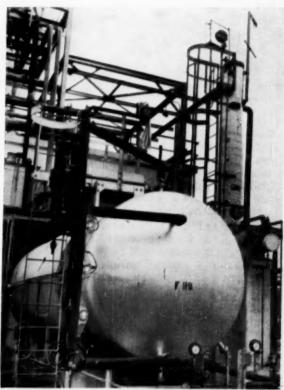
PRODUCT REFINING: Three bubble-cap towers split acid into product fractions; fourth gets custom cuts.



PREPARATION: Light overhead, sludge botlit from feed in 35-ft.-tail bubble-cap tower.



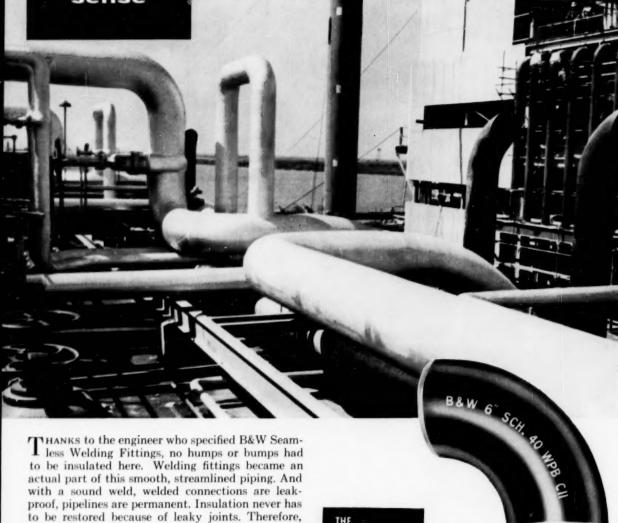
3 EXTRACTION: Sulfur, neutral oil are removed in 60ft. Scheibel tower. Tower, right, recovers naphtha.



DRYING: Water is removed from cresylic acid by decanting in 8,000-gal, tank, distilling in short tower.

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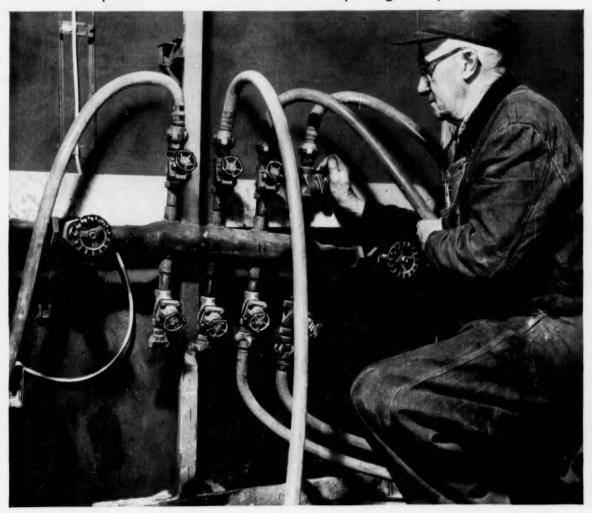
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Crane helps another valve user stop high replacement costs



How they solved valve failure on air service

This case history from Willamette Iron & Steel Co., Portland, Ore., shows how you can cut compressed air handling costs in your own plant.

These Crane packless diaphragm valves are handling 100 psi. air on manifolds to distribution lines used aboard ship during construction. Before installing the Crane ¾-inch No. 1610 valves, the yard was troubled by constantly rising maintenance costs. With the other make valves, diaphragms were rupturing after a short time, requiring continual replace-

ment. Loss of air and air power for equipment was costly.

Crane packless diaphragm valves were installed because their neoprene diaphragm functions only as a bonnet seal, and is not subjected to crushing and wear when used as a seating member. The maintenance problem was effectively solved, as it is for so many users throughout industry, by installing the right Crane valve. Contact your Crane Representative today—ask him for complete information on any application.



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Calcining Operations . . . The Imp Mill is sometimes used for drying and grinding raw gypsum for making wallboard. It is also useful for removing water of crystallization from copper sulphate in producing a mono-hydrated copper sulphate.

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Raymond Imp Mill with package type furnace and Flash Drying Accessories for removing moisture from materials while pulverizing.

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JULY 1957

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Good tool for economic decisions	
Capitalized costs aid in choice of materials, get high rating in the analysis of economic alternatives.	

Continuous process for cresylic acid TURN BACK TO P. 228



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AN OLD TRADE OR A NEW PROFESSION-

What Is "Cost Engineering"?

CECIL II. CHILTON, Senior Associate Editor

As MANY of you turn to this page when you receive your copy of Chemical Engineering near the end of June, the writer and several score other engineers will be at Durham, N. H., in the first annual meeting of the American Association of Cost Engineers.

Just one year earlier, 60 men from all parts of the U.S. and Canada had met at the same location to organize the new association. If my experience is at all typical, these men, when they got back to their desks that Monday morning in June 1956, were bombarded with questions from their less fortunate associates, such as:

"How come you left here last week as an estimator and came back as a cost engineer?"

Or.

"What are you fellows trying to do, invent a new branch of engineering?" Or,

"Just what is a cost engineer, anyway?"
To answer such questions, most of us could fall back on the definition of "cost engineering" as approved by the founding members of AACE:

"Cost engineering is defined as the application of scientific principles and techniques to problems of cost estimation, cost control and profitability."

But I have wondered ever since just what was the true stature of cost engineering. Is it really a new profession, or is it just an old trade, or is it something else again? In this article, we'll explore several aspects of this question.

We all recognize certain major branches of engineering practice, such as civil engineering, electrical engineering and chemical engineering. We may even accept such narrower fields of specialization as highway engineering, radio engineering and nuclear engineering.

Can the American Association of Cost Engineers claim comparable status for cost engineering? At the risk of losing my good standing as a founding member and director of AACE, I'll make this flat statement:

There is no such branch of engineering as cost engineering!

Such a statement demands explanation.

Let's start by analyzing the word "engineering."

An engineer, according to one of the more widely used definitions, is a person who can do for one dollar what any fool could do for two dollars.

Even the more formal definitions of engineering emphasize the key function of economics in the engineer's activities. The American Institute of Chemical Engineers, for example, defines "chemical engineering" as ". . . the application of the principles of the physical sciences, together with the principles of economics and human relations . . ."

Practical engineering, therefore, is largely a matter of costs.

In enterprises operated for profit, the emphasis on costs is essential in order to return to the owners of the business a fair return on their investment. But even in nonprofit organizations, government projects, military operations, and so forth, the engineer must still be conscious of costs, although the emphasis may be in terms of materials, manpower or the taxpayers' money, rather than the owners' profit.

The study and application of economics to technical problems, therefore, is the primary characteristic which distinguishes the engineer from the scientist. This does not mean that the average scientist is not concerned with practical matters. Most scientists—at least those in industrial jobs—learn to think in terms of how their discoveries might be put into practice.

But the engineer, with his training and experience in plant design, cost estimation, organization and management, is better fitted for the task of translating the scientist's discoveries into workable, profitable commercial operations.

Just above I said that there was no such branch of engineering as cost engineering. What I could have said, and what I really believe, is this:

All engineering is cost engineering!

Now I'll try to prove that statement. The principle of free enterprise, as applied to most types of business and industry, can be expressed in the form of a simple equation:

$$\left(\frac{S-E}{I}\right)y=r$$

In this equation

- S is the money coming into the business from the sale of goods and services over a certain period of time;
- E is the money paid out for materials, labor, taxes and all other expenses over the same period of time:
- I is the money invested in the business, in both permanent facilities and in working capital;

y is a "risk factor";

r is the return on the investment, expressed as a fraction or decimal based on the given period of time.

This equation is easily recognized as a fundamental expression of the economic facts of life.

When it reports historical data, such as the performance of the business for the year 1956, S, E and I are firm figures, the factor y is, of course, 1.0, and return on investment r is calculated as a definite value.

For any future period of time, however, where S, E and I must be estimated, y represents the probability that return r will be realized. This is just as true for an old, established business as it is for a proposed venture, the basic difference being that y should be closer to 1.0 for the established business.

It's obvious from inspection of the equation that anything the engineer does to maximize S and y will help the business. By the same token, we want to minimize E and I. Let's examine some of the jobs that engineers do in terms of their effects on S, E, I and y.

Here are some of the jobs which serve to maximize S, the amount of money coming into the business:

- · Selling.
- · Customer service.
- · Advertising.
- · Public relations.
- · Market development.
- Quality control and improvement.
- Package design and development.

Not all of these are strictly engineering jobs, but you'll find engineers doing all of them.

Here are some engineering jobs which help minimize E, the amount

of money paid out by the business for materials, labor and other expenses:

- · Mechanization to save labor.
- Standardization of supplies and methods.
 - · Corrosion studies.
 - · Yield studies.
- Operating supervision and cost control.
- Studies of financing methods.
 Here are some of the jobs in which the engineer tries to minimize I, the money invested in the business:
 - · Plant design.
 - · Inventory control.
- Selection of process or equipment alternatives.
 - · Leasing studies.
 - Construction cost control.

How can the engineer maximize y, the probability factor? By:

- Market research.
- · Process research.
- · Pilot-plant studies.
- Consulting, teaching, techni-

cal writing and editing.

Maybe the last item seems out of place. Fundamentally, however, the function of the editor, teacher or consultant is to impart knowledge and advice to the person doing the actual engineering work. This increases the probability that the engineer will perform at his maximum level of ability.

Similarly, I believe that you can categorize any other useful engineering function according to the effect it has in maximizing S and y and minimizing E and I. And I believe that this proves my point that all engineering is basically cost engineering.

It would seem perfectly logical to conclude, then, that all engineers are cost engineers. Unfortunately, such is not the case.

Many engineers are technically proficient but economically ignorant. How often we hear of some development which is technically a success but economically a failure! How often will an otherwise well trained and experienced engineer make an engineering decision based on thorough technical investigation but inadequate economic study?

A common engineering error is to apply one set of economic conditions to another problem without checking to see if the conditions fit.

For example, in Perry's "Chemical Engineers' Handbook" there is a full-page chart labeled "Economic pipe diameter." It consists of a nomograph with three scales. All you need to know is the lb./hr. of fluid flowing through the line and its density; the chart then tells you the optimum economic size of pipe to use.

Or does it? Nowhere in the derivation of the equation forming the basis of the chart does the handbook editor tell the engineer the factors he used for amortization or maintenance, the cost of energy or the cost of pipe. Yet many engineers blindly use this chart for sizing of actual process pipelines. And in many cases piping is the biggest single cost item in construction of a process plant.

There's another economic booby trap in this same operation. Suppose the chart indicates that the so-called economic pipe diameter for a certain fluid and flow rate is 6.17 in. This is greater than the I. D. of 6-in. Schedule 40 pipe, so the engineer specifies the next larger size, 8 in. The handbook even tells him to do so: "It is more economical to select the next standard pipe size above the actual diameter determined."

Is it really? Under certain conditions (especially with alloy pipe) it will be more economical to shade the diameter by 5%, and pay a little bit more for pumping energy, than to use a pipe 50% heavier than needed.

What accounts for the apparent lack of cost consciousness or economic savvy in many otherwise capable engineers?

For one thing, most engineering graduates leave the college campus with less-than-adequate formal instruction in engineering economics. There is so much pressure on the engineering curriculum to give the boys all the technical courses they can hold that there is little place left for practical economics.

Presumably the educators figure that the graduate engineer can learn the economic facts of life after he gets his feet wet in industry. Many of them do, of course, but not before making some needless economic blunders.

Besides, its not always easy to pick up this familiarity with economics while on the job, especially if you work for the chemical industry. There has been a traditional reluctance on the part of chemical management to give young engineers access to cost figures or to allow their participation in economic decisions.

Fortunately, some of these conditions are changing.

Formation of the American Association of Cost Engineers is one evidence of this trend. And many colleges are now getting a greater emphasis on engineering economics into the engineering curricula.

Another evidence is seen in the published literature. Prior to 1946, the literature on process equipment cost data was almost a complete blank. In the past 11 years, however, Chemical Engineering alone has published more than 100 articles in the field of cost engineering. And while we pioneered in this field, some of our alert contemporaries have recently joined us in spreading the cost engineering gospel.

The construction industry and metal-working job shops, of course, have always been extremely cost conscious. But the process industries seem to have embraced cost engineering only in recent years. This is especially true in research and development work.

Du Pont now recognizes cost engineering as an essential part of development work. In a new booklet designed to tell chemical engineers about career opportunities at Du Pont, special attention is given to the function of "scouting cost studies":

"From cost analysis work the young chemical engineer gains much valuable experience. He learns more about company operations and management's viewpoint."

Emphasis on cost engineering has increased to the point where many companies need more engineers for this work than they can spare from their own ranks. Openings like these appear with increasing frequency today:

 "Chemical engineering economist . . . demands good business sense and a preference for work in the field of economics."

• "Chemical cost analyst . . . with training and experience in economic analysis."

 "Chemical engineers are needed... in economics... estimating costs and comparing possibilities from a business (cost and profit) point of view."

• "Cost engineer . . . estimat-

ing chemical plant capital costs . . . knowledge of operating cost estimations necessary."

"Engineering research . . . technically trained people with exceptional qualifications in . . . engineering economics."

• "Estimating and economic evaluation . . . to study and evaluate the economics of proposed systems and to estimate the cost of complete plants."

What accounts for the rise of the cost engineer in the process industries? The answer to this question, I believe, is a basic shifting in the economic patterns of industry.

For example, in 1939 the average chemical company, for each \$1.00 in sales, paid out 77¢ in total expenses, leaving a net profit of 23¢.

However, by 1953 the picture had changed. Expenses now accounted for 89¢ of each sales dollar, leaving a margin of only 11¢.

Although I don't have comparable figures for 1956, the situation last year was even worse. In spite of bigger sales volumes, chemical companies, generally speaking, were showing weaker profit margins. Here are some typical comments from 1956 annual reports:

 "The principal problem we face in the coming year is the effect on earnings of the continuing increase in the cost of doing business."

• "The benefits of our increased business volume were offset by narrowed profit margins. . . . Costs continued to rise but competitive conditions prevented corresponding price increases."

 "Your company was not alone during the 1956 fiscal year in weathering the stormy corporate seas of stiffer competition, increased costs of materials and labor, and a falling barometer of profits."

Such conditions put tremendous pressure on management to examine every expense more critically than ever, to control all costs, to channel research dollars where they will yield the greatest benefit. As one company puts it:

"In order to increase our earnings, we are examining every item of cost... We have improved and tightened up our estimating procedures and have instituted better methods for controling all phases of our projects."

Compare this company's objectives with our definition of cost engineering and you will readily see why the cost engineer is becoming a key man in the chemical process industries.

So far, we have discussed several aspects of cost engineering but have said little about cost estimation. This is where we face the question of trade vs. profession.

I look upon cost estimation as one of the professional tools of the cost engineer. To the professional engineer, the cost estimate is a means to an end, not an end in itself.

Its ultimate purpose is to provide the basis for a decision. This may be a completely technical decision, such as whether to use a continuous centrifugal instead of a rotary vacuum filter. Or it may be an administrative decision, such as whether or not we expand the plant.

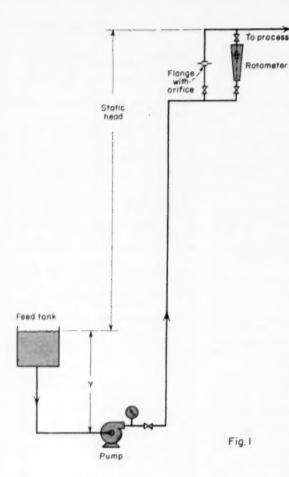
While the cost engineer often makes his own cost estimates, in large engineering organizations this isn't always practical. This gives rise to a specialized function fulfilled by an individual or a group called cost estimators. Estimators often are engineering graduates and/or registered engineers; such men are certainly qualified to function in a professional capacity. On the other hand, some estimators perform completely routine tasks under the direction of professional engineers. I would hesitate to apply the term "cost engineer" to people functioning on this subprofessional level.

So back to the original question: Is cost engineering an old trade or a new profession?

As I have defined it, cost engineering is truly a profession, not a trade. However, it is far from a new profession.

I would liken cost engineering, rather, to a nova, the term the astronomers apply to a star which has been in the firmament ever since the dawn of creation but which suddenly begins to shine with greatly increased brightness. Those of you, therefore, who function as cost engineers should be proud to be part of this professionis nova.

This article is based on a talk given by the author to the Northeastern Ohio section of the American Association of Cost Engineers, Cleveland, March 27, 1957.



RALPH A. TROUPE Northeastern University, Boston, Mass.*

A metering bottleneck is often encountered when process requirements grow and a greater liquid capacity must be delivered. The problem is the range of the rotameter in the line which may no longer be sufficient to record the flow.

Of course, a meter having a greater range could be purchased. But, as many engineers already know, the range of the existing rotameter can be extended in a simple way as shown here.

After deciding to up the process capacity, it is best to turn the rotameter control valve wide open and see whether the centrifugal pump in the line can deliver the increased flow. It may be found that the speed of the pump drive will have to be raised in order to obtain the larger flow rate.

In practically all rotameter installations, a bypass line is provided around the rotameter as in Fig. 1 so that flow may continue uninterrupted if the rotameter is ever removed. The trick of extending the range is to place an orifice between any convenient pair of flanges in this bypass line.

Then when the greater flow is desired, the valve in the bypass line can be opened wide and the proper flow obtained by regulating the valve in the main line. This setup also allows the rotameter to be operated in its normal flow range by closing the bypass line.

Bypass Orifice

When the rate of flow in a process line is boosted past the range of an existing rotameter—you may not need a new one. You can extend its range in a very simple way. The trick is to place an orifice between a pair of flanges in the bypass line.

This method will give extremely accurate results if (a) the range of the rotameter is not extended more than 80% and (b) the combined range of the orifice and the rotameter is not greater than 80% of the maximum flow rate through the original bypass line with no orifice installed. Beyond these conditions the accuracy will decrease. The more these conditions are exceeded, the greater the decrease in accuracy that will occur.

The only problem remaining is to calculate what size orifice to insert in the bypass and to determine the new calibration of the rotameter. Here, for the first time, is the step-by-step explanation of exactly what is involved in tackling this problem.

How to Relate Pump Head to Capacity

To design the orifice for the bypass, the head-capacity curve that came with the centrifugal pump should be consulted. If a curve is not available, a rough characteristic pump curve can easily be determined by following these three simple steps:

Step 1—Record the discharge pressure of the pump at various rates of flow, together with the corresponding rotameter readings. When the limit of the rotameter is reached, continue to increase the flow and record the discharge pressure of the pump. The corresponding flow rates should be measured in some convenient manner.

Step 2—Convert the discharge pressure readings from psig. to ft. of the liquid being pumped. This can be done by using the following formula: Head (ft.) = 144 psig./62.4 sp.gr., where sp.gr. is the specific gravity of the liquid being pumped.

Step 3—Measure the distance from the centerline of the pump to the liquid source (Y in Fig. 1). If this distance is positive (that is, the level of the

Nomenclature -

- D. Orifice diameter, in.
- D, Actual inside pipe diameter, in.
- Resistance due to the orifice, ft. of liquid
- G Total flow rate, gpm.
- G. Flow rate in the orifice line, gpm.
- H Head, ft. of liquid
- V. Linear velocity of liquid in the pipe, ft./sec.

[•] Meet your author on p. 319.

Extends Range of Rotameter

source is higher than the center line of the pump), subtract the distance in ft. from each of the heads calculated in Step 2. If the distance is negative, add it to each of the heads. This calculation gives the head developed by the pump at each of the corresponding flow rates.

When these data are plotted they will serve as the head-capacity curve for the pump. Such a plot appears

Sizing the Orifice

We are now ready to get the exact size of the orifice

that is to be placed in the bypass.

Step 1-On the head-capacity curve for the centrifugal pump, draw a horizontal line at the head corresponding to the difference in levels between the source and the discharge point (static head).

Step 2-Calculate at various flow rates the head due to friction for the piping system (as ft. of liquid) up to the point where the rotameter and its bypass are installed. This can be done by methods found in many texts and handbooks, or from friction tables. Plot these data on the head-capacity diagram for the pump. If this curve is drawn as indicated in Fig. 2, using the static head line as a base, it represents the total head opposing flow.

Correction for velocity head is usually small and therefore has been neglected in our analysis. In the procedure outlined here we have also assumed that there is no difference in pressure between the ends of

the system.

Step 3-Decide on the total new high flow rate that you want with the rotameter float at the top of the scale when using the orifice in the bypass line. Mark the point on the head-capacity curve corresponding to this flow rate (point A in Fig. 2). The difference between this chosen value and the upper limit of the rotameter scale will be G_{\circ} , the capacity of the orifice line when the rotameter float is at the top of the scale.

Step 4-Go vertically downward from the point A on the head-capacity curve of the pump to the total head plot (point B). The distance AB represents the resistance to flow F_{\bullet} in the orifice line. It also represents the resistance to flow in the rotameter line since these lines are in parallel (Fig. 1).

Step 5-Calculate the linear velocity, in ft./sec., of the liquid flowing in the bypass pipe in which the orifice will be inserted, by use of the following formula:

$$V_p = \frac{G_o (4) (144)}{(7.48) (\pi) (D_p)^2 (60)}$$

where V_s is the linear liquid velocity in ft./sec.; G_s is the flow rate in the orifice line in gpm.; and D_{ρ} is the

inside pipe diameter in inches.

Step 6-Refer to Fig. 3, in which the friction due to the orifice line F., divided by the square of the linear velocity in the pipe V_p , is plotted against the ratio of orifice diameter to pipe diameter D_o/D_p . Having evaluated V_{\bullet} , we can square it and divide into the value of F, found in Step 4 above. Fig. 3 will then give the corresponding value of D_o/D_{ν} .

By multipling this value by D, you can arrive at the diameter of the orifice,

Get Rotameter's New Calibration Curve

All that remains now is to recalibrate the rotameter. In five easy-to-follow steps here is how this is done:

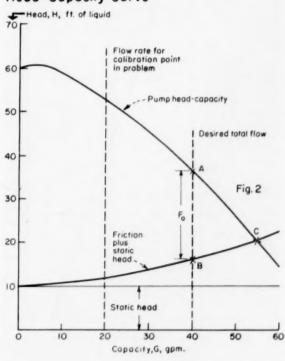
Step 1-Select several flow rates that are less than the maximum flow rate of the rotameter and orifice combined. For example, if the maximum flow is 40 gpm., you could select 30 and 20 gpm.

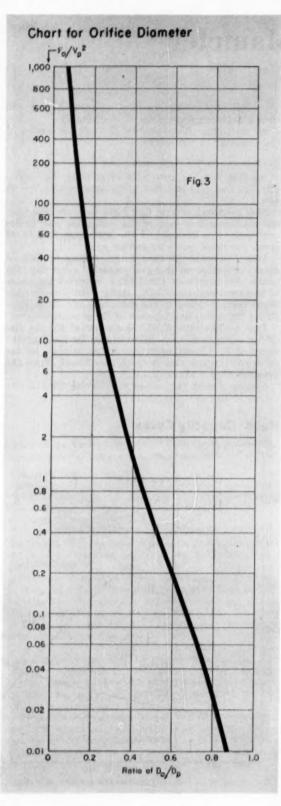
Step 2-Locate the head corresponding to each of these capacities on the head-capacity curve for the pump. From each of these heads subtract the value of the total resistance (i.e., static head plus friction head) corresponding to the same capacity. This gives F, for the orifice line for each of these conditions.

Step 3—The ratio F_{\circ}/G_{\circ} is a constant for the size orifice selected and can be evaluated by dividing the value of F_{\bullet} (found when sizing the orifice) by the square of the flow rate in the orifice line G_o , from the previous Step 3 above.

Step 4-Insert the values of F, from Step 2 into

Head-Capacity Curve





the relation $F_{\circ}/G_{\circ}^{\circ} = a$ constant, using the constant just determined and solve for G_o . This will give the rate of flow in the orifice line for each of the total capacities selected.

The flow rate through the rotameter will be the total capacity selected, minus the corresponding rate

in the orifice line.

Step 5-Plot the rate of flow through the rotameter against total capacity to obtain the new calibration curve. This curve will be a straight line in almost all cases, and hence only two points will be needed.

Sample Problem

In the piping arrangement of Fig. 1, the static head is 10 ft. Say that the piping consists of 30 equivalent ft. of 12-in. Schedule 40 steel pipe. We want to increase the flow to 40 grm., but the range of the rotameter tube is only 30 gpm. Assume that the head-capacity curve in Fig. 2 applies to the centrifugal pump in the system.

Step-by-Step Solution

In 8 quick steps (the first six to determine the orifice diameter and then two more to develop the new calibration) we can solve our problem.

Step 1-Represent the static head of the system

by a horizontal line at H = 10 (Fig. 2).

Step 2-The piping friction curve has been represented by the line originating at G = 0, H = 10and intersecting the pump characteristic curve at point C. Since it is drawn with the static line as a base, the curve represents the total resistance to flow of the system except for the rotameter and bypass assembly. The piping friction here is small by comparison to the rest of the system and therefore can be neglected.

Step 3-Point A on the head-capacity curve represents the desired 40 gpm. as does point B on the friction-plus-static head curve. The capacity of the orifice line G_s at a total flow of 40 gpm, would be 40-30 or

10 gpm.

Step 4—The value of H at point A is 36 ft. and at point B is 15.7 ft. Thus, the resistance F_o in the orifice line (and the rotameter line) would be AB = 36 -15.7 or 20.3 ft.

Step 5-The linear velocity V, in the orifice pipe line is

$$V_{\,p} = \frac{(10) \,\, (4) \,\, (144)}{(7.48) \,\, (3.14) \,\, (1.61) \,\, (1.61) \,\, (60)}$$

 $V_n = 1.58 \text{ ft./sec.}$

Step 6—Now that V_p is known, $F_s/V_p^s = 20.3/(1.58)^s$ = 8.12. From Fig. 3, $D_{\circ}/D_{\circ} = 0.26$ and $D_{\circ} = (0.26)$ (1.61) = 0.419 in.

Step 7-For a point on the new calibration curve of the rotameter, select a total flow rate of 20 gpm. The value of H at 20 gpm, is 52.5 ft, on the head-capacity curve and 11.5 ft. on the resistance curve. Thus F_* is 52.5 - 11.5 or 41 ft.

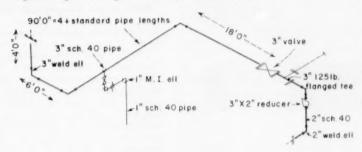
Step 8-Evaluate the rate of flow in the orifice line by obtaining the constant for the ratio F_{\circ}/G_{\circ} In Step 4 F_s was 20.3. G_s is 10, so $F_s/G_s=20.3/(10)^s=0.203$. In Step 7 $F_s=41$, so $41/G_s^s=0.203$ and $G_{\circ} = 14.2$. Thus, the rotameter reading will be 20 -14.2 or 5.8 gpm.

Another point may be calculated in a similar manner and then the new calibration curve drawn through

the two data points.

Accurate Way to Estimate Pipe Costs

Use Engineering Drawing to Take Off Dimensions



Tabulate Dimensions From Engineering Drawings

	No.	Connections	Dia. In.
1-in. dia. ells	2	4	4
1-in, dia. union	1	2	2
1-in, dia. valve	1	2	2
1-in. dia. coupling	1	2	2
			10
2-in. dia, ell	1	2	4
2-in. dia. reducer	1	1	2
2-in. dia. flange	1	1	2
			8
3-in. dia. pipe	118 ft.	4	12
3-in, ells	4	8	24
3-in. flanges	4	4	12
3-in. reducer	1	1	3
			51
Bolting up 3-in. valve	1	2	6
Bolting up 3-in. tee	1	2	6
			1.0

* Number of connections multiplied by pipe dia.

Get Labor Factors From Tables

Pipe layout, cutting, welding, threading, and erection:

Man Hours Per Dia. In

man noors for bia. in.						
Carb. Steel Sch. 40	Stainless Steel Sch. 5 & 10	Saran-Lined				
1.30	1.60	1.50				
1.00	1.30	1.50				
0.90	1,25	1.40				
	Carb. Steel Sch. 40 1.30 1.00	Carb. Steel Steinless Steel Sch. 40 Sch. 5 & 10 1.30 1.60 1.00 1.30				

Flanged valves and fittings; handling and bolt Pipe Size	ing up: Man Hours Per Dia. In. Per End
1/2 through 11/2 in.	0.40
2 and 3 in.	0.35
A 1=	0.25

Multiply Labor Factors by Dia. In.

	Dia. In.		Labor	Facto	F	Man	Hours
	10	×	1	30	-	13	
	8	×	1	.00	200	8	
	51	×	1	00	200	51	
	12	×	0	35	-	4	20
Total man hours	fabricate and	erect				76	20

W. G. CLARK The Dow Chemical Co., Pittsburg, Calif.*

Piping is a major item in the cost of chemical process plants. Frequently it is as high as 60% of installed equipment cost.

Much has been published on cost of piping, "although this information is rapidly going out of date. We will present new data and methods for estimating labor and material cost, based on experience at Dow Chemical. The cost data cover carbon steel, stainless steel, and Saran-lined pipe in sizes to 8-in. dia.

Which Method Is Best?

There are two basic and popular methods for preparing piping cost estimates:

• Percentage of installed cost. This is an excellent method for preliminary or order of magnitude type estimates. In the hands of experienced estimators it can be a reasonably accurate method, particularly on repetitive type units. It is not recommended on alteration jobs or on projects where the installed equipment cost is less than \$40,000 to \$50,000.

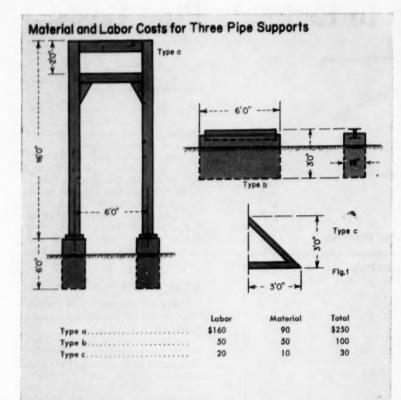
• Labor and material take-off. This is the recommended method for authorization estimates where accuracy within 10% is required. Usually, to prepare a piping estimate with this method, you need piping drawings and specifications; material costs; auxiliaries, supports, painting, etc., fabrication and erection labor costs; testing costs; overhead and profit. This is the method we will discuss.

Must Have Drawings and Specs

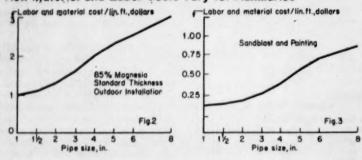
Experience indicates that with engineering 40% to 50% complete, there is sufficient information available, in the form of piping flow-sheets, plans, elevations, isometrics, etc., to prepare a material take-off.

This take-off must be made with the greatest possible accuracy. It is the basis for determining labor and material cost. In the case of revisions to existing facilities, thorough field study is necessary to

^{*} Meet your author on page 320.



How Material and Labor Costs Vary for Auxiliaries



Costs of Gasket and Hanger Material Material cost each, dollars 150 lb. boilt and gasket set Clevis hanger Fig. 4 Pipe size, in.

determine job conditions and their possible effects.

Figuring Material Cost

Material cost are generally taken from manufacturer's catalogs and discount sheets. Another method is the use of graphs of the type shown in Fig. 5. These, with quarterly review, can be accurate within 3%.

There are auxiliary items (sandblasting and painting, insulation, gaskets and hangers, supports) which if omitted, may result in under estimated cost. Costs of these items are shown in Figs. 1-4. Supports shown in Fig. 1 are typical of those used by Dow.

Calculating Labor

Piping labor consists of cutting, fitting, welding and/or threading and field assembly. It may frequently be as high as 200% of material cost. This labor is generally calculated on either the "lineal foot" method or "diameter inch" method.

The lineal foot method requires a great deal of back up data for each line size, and for varying conditions of complexity. Obviously, these factors are difficult to develop and require considerable judgment in their use.

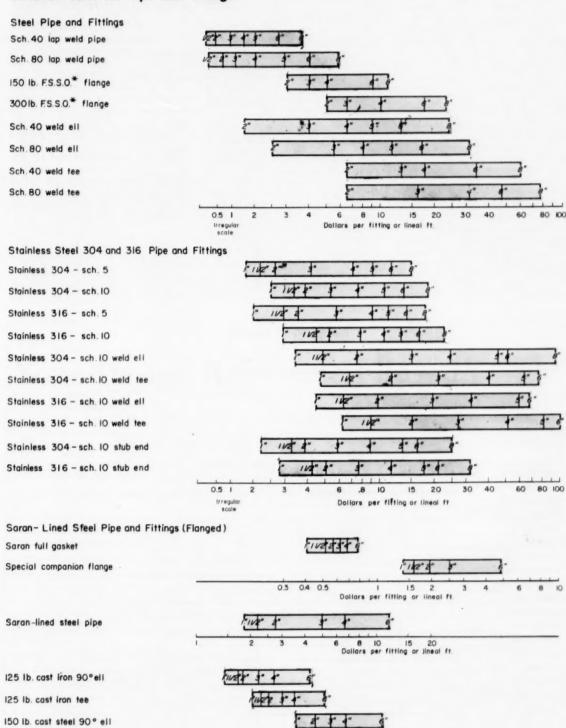
The diameter inch method is used and recommended by the author. In this method you count all connections (threaded or welded), multiply by nominal pipe diameter, and multiply this total by labor factors. To this must be added a bolting up charge for all flanged connections (see sample calculation p. 243).

This method is unusual in that no consideration is given to lineal feet of pipe. However, in the development and checking of labor units it became clear that there is practically no labor significance to the distance between connections. Amount of cutting, welding layout and handling is, for all practical purposes, identical whether a pair of elbows are 2 ft. or 12 ft. apart in a system. When standard lengths of pipe are joined together, this is counted as a connection and is reflected in the diameter inch total.

Labor Factors Are Important

Based on analysis of actual jobs involving process piping of average complexity, labor units for complete

Material Costs for Pipe and Fittings



20

30 40

Dollars per fitting or lineal ft,

*Forged steel, slip-on, 150 psl.

Fig.5

fabrication and erection are given for pipe layout, cutting, welding, threading, and erection (p. 243).

When calculating Saran-lined pipe labor, particular care should be taken to list all 10-ft. lengths separately. This is stock length, shipped prethreaded and flanged. Therefore, it requires no fabrication prior to erection. Allow 1.4 manhours per dia. in. per length for handling, erection and bolting up companion flanges.

A separate table is shown for flanged valves and fittings; han-

dling and bolting up.

There are four factors based on job conditions which will affect these units. For highly complex piping, add 10% to 30% to the labor units. For piping above second floor level in open process towers, add 10%. Elevated piping, not in proximity to normal working platforms, add 10% to 20%. If

scaffolding is required, add as an extra. For areas of long straight runs, deduct 8% to 12%.

These factors should be applied only to the areas directly concerned, since most jobs have major areas of normal piping.

Testing is not included in the labor units. An allowance of 5% of total labor will generally cover normal testing procedures.

Getting Overhead and Profit

A final and important item of piping cost is overhead and profit. All costs here, with exception of Figs. 2 and 3 (painting and insulation) are based on direct labor (wages to craftsmen) and direct material. Figs. 2 and 3 are subcontract costs for labor and material and should be marked up 15% to 30% depending on local contractor practices. Material costs are

for Oct. 1956 in the Northern California area. A figure of \$3.75/manhr. for pipe fitters has been used in our calculations for labor.

Overhead may vary with each contractor, but will generally be from 50% to 65% of total direct labor; 8% to 10% of material.

Profit is also a variable item, depending primarily on local business conditions, ranging from 5% to 12% of total project cost.

Overhead usually includes payroll taxes, fringe benefit contributions, travel time, moving on and off jobsite, permits, insurance, equipment rental, supervision, construction shacks, field office personnel, consumable supplies, sales and use tax, first aid, tool maintenance.

REFERENCES

1. Dickson, R. A., Chem. Eng., Jan., pp. 123-145, (1950). 2. Bliss, H., Chem. Eng., May, pp. 126-130, (1947).

		Pip	oing Bill of	Material				
JOB NO. 1436		TAKE OFF BY: D. A. K.						PAGE 1.
PLANT: J-16			CHECKED BY: W. G. C.					
	MATERIAL; STEEL (S40) SIZE; 2 IN.		_			MATERIA SIZE: 4	Marie Marie	
ITEM	NO. REQ'D.	\$ UNIT	\$ TOTAL	DIA. IN.*	NO. REQ'D.	\$ UNIT	\$ TOTAL	DIA.
LENGTH (LINEAL)	150 ft.	0.40	60.00	10	145 ft.	10.50	1,520.00	20
MALLEABLE IRON 90° ELL								
MALLEABLE IRON TEE								
MALLEABLE IRON UNION								
WELD ELL	6	1.60	9.60	24	4	32.00	128.00	32
WELD TEE	3	6.50	19.50	18	1	51.00	51.00	12
FORGED STEEL, SLIP-ON FLANGE	8	3.00	24.00	16				
MALLEABLE IRON REDUCER								
WELD REDUCER	1	12.00	12.00	3	-			
STEAM TRAP								
GATE VALVE	2	39.00	78.00		2	165.00	330.00	
GLOBE VALVE	1	43.0	43.00					
PLUG COCK					-			
CHECK VALVE								
STRAINER	*							
STUB END					4	11.50	46.00	16
BOLTS AND GASKETS	4	0.70	2.80		4	1.40	5.60	
HANGER	7	0.60	4.20		7	0.80	5.60	
VAN STONE FLANGE					4	5.00	20.00	
TOTALS			\$253.10	71			\$2,106.20	80

Topics and Organization of this CE Reference Series

Section I

Tanks Reactor design Mixers and agitators Materials handling

Section IV Compressors Jet ejectors and eductors Design and cost estimating

In This Issue

Section VII

Materials of construction Corrosion Paints and coatings Physical data

Section II

Piping Fluid flow Pipe, hose, tubing Valves, traps, special fittings Fabrication and installation Piping identification Pipe supports and thermal stress

Section V

Heating Ventilating and air conditioning Insulation **Power transmission**

Section VIII

Separation processes Distillation, evaporation Absorption Drying Air pollution **Dust collectors Entrainment separators**

Section III

Pumps and pumping Water supply and treatment Electrical power

Section VI

Heat transfer Heat exchangers Chemical engineering

Section IX

Instrumentation Refrigeration Structural engineering Illumination

Your Design Reference File—IV

Use these references to find information quickly on selection of compressors, ejectors and eductors; on design and cost estimating; and for labor, equipment and general cost indices.

RALPH CUSHING, Senior Process Engineer, Mobay Chemical Co., St. Louis, Mo.*

Compressors

General Selection

"Handling Compressible Fluids," C. S. Cronan & T. R. Olive, Chem. Eng., June 1956, pp. 175-238.

A composite report by various authors as below:

"Handling Compressible Fluids in Chemical Processing," Paul R. Des Jardins, pp. 178-187. Air separation plant; non-lubricated compressors; compression limits; vacuum pumps; ammonia synthesis; high pressure processes; refrigeration.

"Factors That Influence Selection of a Compressor,"

"Factors That Influence Selection of a Compressor," William T. Alderson, pp. 188-195.
Factors to be weighed before choosing between positive displacement and dynamic machines; gas properties; specific heats; compressibility; contaminants; moisture content; limiting conditions; flow rate; temperature; heat balance; pressures; operating costs; maintenance costs.

"Steam Jet Ejectors," Robert Frumerman, pp. 196-

Velocity pressure change; characteristic curves; condensing or non-condensing; sizing; steam and water usage; costs.

"Fans and Blowers," Arthur N. Rogers, pp. 202-205. Fan types; characteristics; blade types; control methods; testing and rating.

"Centrifugal Compressors," E. S. Leonard, pp. 206-

Principles of operation; hydraulic efficiency; speed and diameter; design consideration; regulation; selection; installation.

"Axial Compressors," R. E. Claude, pp. 211-215. General introduction; efficiency; performance characteristics; flexibility; costs.

"Reciprocating Compressors," E. L. Case, pp. 216-223. Applications; arrangements; drives; design; high pressure; non-lubricated type; problems of corro-sion; vacuum pumps; capacity controls; installation and operation; deposits.

"Rotary Compressors and Vacuum Pumps," W. L. Bruce & W. A. Schubert, pp. 224-226.
Operating range; flow characteristics; flow control; application and operation.

[°] For author biography see Chem. Eng., Mar. 1957, p. 326.

"Drivers, Controls and Accessories," Richard Hancock, pp. 227-238.

Electric motors; steam drives; internal combustion engines; capacity regulation; capacity curves; centrifugal compressors; accessories, inter- and aftercoolers; separators; pulsation dampening; cooling water systems.

"Centrifugal Compressors Symposium," Pet. Refiner, Jan. 1955, pp. 117-146.
Industrial sections and authors listed below:

"Introduction and Principles," W. O. Lowell, pp. 118-

Types discussed; capacities.

"Theory of Operation," H. A. Erb, pp. 123-129.
Thorough coverage of operational theory with development of equations for heads and efficiencies.

"Important Performance Characteristics," T. P. Latimer, pp. 130-131.

Type and ranges of application; pressure volume characteristics; parallel and series operation; performance calculations; heads, horsepower, speed, volume calculations.

"Process and Mechanical Design," Cark Shields, pp. 132-135.

General considerations; lubrication systems; oil fil-tration; requirements for foundation; accessibility for maintenance.

"Specification and Selection," O. A. Smith, pp. 136-

General and specification data; general design and materials; price estimates; shipment and storage.

"Operation and Maintenance," S. L. Cole & G. D. Peet, pp. 140-142. Start up procedure; operation; shut down; mainte-

nance.

"Seals and Sealing Systems," D. F. Crego, pp. 143-146. Single direct acting seal; stuffing boxes; double seals; gas injection system; fluid injection system.

"Compressing Air," Tyler Hicks, Power, June 1953, pp.

How compressors work; reciprocating types; rotary types; centrifugals; axial flow types; portables; compressor accessories; control; selection; system layout; piping; compressor cooling; operation and mainte-

Compressor Selection

"Capacity Control of Small Compressors," S. R. Hirsch,

Capacity Control of Small Compressors," S. R. Hirsch, Plant Engineering, June 1956, pp. 120-123. Features of several types of air compressor controls, describing attributes and limitations of each; unload-ers also discussed.

"Matching Motor to Centrifugal Compressors," G. L. Oscorson, *Power*, Nov. 1955., pp. 75-77, 208.

Importance of inertia in applying centrifugal compressor motors; characteristic head curves; starting torque; enclosures; couplings.

"Guide for Selecting Small Air Compressors," Plant Engineering, May 1955, pp. 111-114.

Chart to convert compressed air to free air; horsepower requirements; cylinder stroke vs. capacity; air flow through nozzles.

"How to Select Compressors," Louis J. Murphy, Pet.

How to Select Compressors, Louis J. Murphy, Pet. Refiner, Feb. 1953, pp. 115-118.

Data and information which provide a basis for choosing the proper type and size compressor for given requirements; some cost data.

"Estimate Compressed-Air System Leakage," Mill and Factory, Aug. 1955, p. 110. Nomographic solution.

"How to Design and Operate Gas Jet Compressors," F. H. Dotterweich, & C. V. Mooney, Pet. Refiner, Oct. 1955, pp. 104-109.

Description of a low-cost method of putting low pressure gas into high pressure gas lines; applications; theory; design and operation; development of formulas; example worked out in detail.

"Tailor Centrifugals to Your Conditions," C. F. Koenig & L. J. Holveck, Pet. Refiner, Oct. 1955, pp. 110-115.

Matching compressor capabilities to system requirements; design for ultimate load; power requirements; long distance transmission; characteristic selection; testing.

"Atmosphere Affects Air Blowers," W. A. Rostafinski, Pet. Refiner, Oct. 1955, pp. 116-120.

A description of how atmospheric behaviour affects air blower performance; determining point of maximum efficiency, flow and pressure; proper basic conditions at suction pressure, temperature, and humidity; methods of regulation; change in performance with variation of air inlet temperature.

"How to Design Compressor Accessories," L. J. Murphy, Pet. Refiner, Mar. 1953, pp. 137-140. Deals with filters; piping and inter- and after-coolers; air receivers.

"Engineering Compressed Air Systems," L. J. Murphy, Pet. Refiner, Dec. 1952, pp. 139-143. Capacity; design; tabulation of air consumption of pneumatic tools; pressure required; system types; pipe sizing; layout.

"Characteristics of Gas Compressors," J. N. Mac-Kendrick, Chem. Ind., Oct. 1946, p. 278. Tabular presentation of characteristics of various types of gas compressors.

"Compressor Trouble Shooting Is Easy," E. A. Murray and W. H. Wheeler, *Power*, Aug. 1955, pp. 124-125. Tabular presentation of trouble shooting data for compressors listing causes vs. symptom in a clear

"In Two Minutes You Can Analyze Graphically . . . Centrifugal Compressor Performance," S. R. Steinbock, Pet. Refiner, Feb. 1954, pp. 133-135.

Performance calculations; horsepower calculations; examples worked out.

"Eliminate Compressor Operating Problems," Louis J. Murphy, Pet. Refiner, April 1953, pp. 173-175.

Some troublesome problems in air compressor systems; low air pressure; pipe sizing; air leaks; startup

of new compressors. "How Martin Uses Compressed Air to Replace Vacuum Pumps, at 1/10th Cost," Plant Eng., Feb. 1956, pp.

102-103. A useful and simple manner of converting compressed air to vacuum for use on vacuum holding tools, etc.

"Compressors—Group or Decentralized Arrangement," W. H. Vedder & D. O. Oetinger, *Power And Fluids*, Winter 1956, pp. 6-9.

Advantages and disadvantages of both arrangements; location; compressor services; preventive mainte-nance; control system; accessories; costs.

"Right Distribution Piping Means Better Output, Fewer Losses in Compressed-Air Systems," H. H. Miller, Power, Dec. 1955, pp. 122-123.

Distribution piping design; size and arrangement of piping; pressure drop; line slopes; compressor location; motor driven compressors.

"Do Plant Air Systems Need a New Look?," L. B. Schramm, Power, Jan. 1953, pp. 75-77.
Comparison of centrally located air compressor station with small locally arranged compressor station; pro's and cons; first cost; salvage value; engineering; distribution; pressure drop.

"How to Get Top Efficiency from Compressed Air Power," E. C. Powers, Heating, Piping & Air Cond., May 1951, pp. 88-91.

Leakage; specifications for air powered equipment; number of compressor units; accessories; operating

speeds.

Jet Ejectors and Eductors

"Preliminary Calculations Nomograph for Eductor Performance," Chem. Processing, July 1954, pp. 158, 160. Nomographic solution; applicable only where both motive and suction liquids have the same specific gravity. Data required, total head and total operating head.

"How to Check Your Jet Utilities," P. Messina, J. J. Brown and J. Bohnlofink, Chem. Eng., Jan. 1954, pp.

161-164.

Steam consumption and water requirements of vacuum ejectors in graphical and tabular form. Con-densing jets; noncondensing jets; steam pressure correction factor; noncondensables correction; sample calculations.

"Corrosion Problems in Steam Jet Vacuum Equipment," D. H. Jackson, Chem. Eng. Progress, Feb. 1953, pp. 102-104.

Materials of construction; intermittent operation; new material impurities, lines ejectors; components and their susceptibility to corrosion.

"Keep Your Steam Jet Ejectors Up to Snuff," L. S. Stinson, Power Eng., July 1951, pp. 87-90.

Maintaining full vacuum on ejectors; how to find whether trouble is in ejector or system; maintenance; checking nozzles and diffusers for wear; reassembling an ejector; emergency operation to maintain stable ejector performance, when you can't shut down.

"Selection and Use of Ejectors," D. H. Jackson, Chem. Eng. Progress, May 1948, pp. 347-352. Various types of ejectors discussed with the advantages and disadvantages of each. Estimated leakage rates; vacuum refrigerating system; saturation moisture in air at different temperatures and pressures.

Design and Cost Estimating

Process Engineering

"Process Engineering-Plots Its Course," Chem. Eng.,

May 1948, pp. 95-126.

Present state of the art; future trends; weak and strong points; new operations; fundamental data; material movements; fluid movement; unit operations; kinetic state; physical separation; mechanical separation; unit operation auxiliaries.

Process Evaluation

"Thermodynamics for Process Evaluation," H. C. Van Ness, Pet. Refiner, Jan. 1956, pp. 165-168. Process evaluation using thermodynamics; simplified calculations; ideal work; lost work; illustrated examples.

Process Planning

"Spot Bottlenecks in Your Batch Process," A. R. Valdez,

Chem. Eng., May 1955, p. 208.
Presentation of a simple way to evaluate process time, and set up time schedule to determine optimum batch size and prevent bottlenecks.

Experimental Data Planning

"How to Design Effective Experiments," F. Proschan and A. B. Babcock Jr., Chem. Eng., Aug. 1955, pp. 191Planning; statistical approach; interpretation of data; randomization; factorial design; non-uniform experimental units; interaction of factors; illustrated examples; comparison of methods.

Production Evaluation

"Evaluating Production Performance," D. V. Bierwert,

Chem. Eng., May 1956, pp. 189-192.

A means for deriving your own performance indexes; content of performance report; factor index; summary index; annual comparison.

Flowsheets

"How to Make Flowsheets Easier Reading," I. Rodriquez and T. Garci, Chem. Eng., Feb. 1955, p. 202.

A procedure for simplifying preparation and reading of flowsheets by standardized arrangement of equipment types. ment types.

Miscellaneous Aids

"Some Economic Considerations In Process Design," R. B. Smith and Thorpe Dresser, Chem. Eng. Progress, Dec. 1955, pp. 544-546. How to balance increased investment against forecast

savings or profit; three examples given; economics;

cost comparisons.

"How Fixed-Variable Cost Control Helps Produce Profits," C. L. Wallace, Factory Management and Maintenance, June 1953, pp. 126-129. Break-even chart; fixed-variable laws; use of fixed-

variable control; product breakdown. Illustrated examples.

"Check Your Design Jobs," G. T. Austin, Chem. Eng.,

June 1950, pp. 137-138.

Equipment design and installation; safety; utilities; and services; legal regulations; continuity of service; advantages of precise checks.

"How Statistical Methods Can Improve Chemical Processes," W. R. Pabst, Chem. Ind., Sept. 1946, pp. Processes,"

Statistical methods for quantitative measurements; cost cutting applications; experimental tests; routine control of chemical analyses; quality control; analysis of variance; the likelihood test.

Research

"Estimating Research Cost," J. S. Swearingen, Pet. Refiner, June 1956, pp. 124-125. Collection of information; literature search; review and formulation of a program; laboratory planning of production.

"When to Use a Pilot Plant," J. W. Payne, Pet. Refiner,

June 1956, pp. 126-128.

Extent of application; time scheduling; data required; advantages and disadvantages; type of pilot plants; things to avoid.

"How to Increase Research Profits," Chem. Ind., Mar. 1947, pp. 421-422.

A method for stepping up quality and quantity of process developments in large industrial research laboratories; methods; evaluations; benefits.

"Specifications for a Good Research Report," Chem. Ind., Mar. 1947, p. 407. General rules; details.

"A Guide to Harmonious Collaboration Between Technical Service and Research," Norman A. Shephard, Chem. Ind., July 1945, pp. 73-74.

Method of preventing friction between 'Research' and 'Technical Service,' advantages of cooperation.

"Expansion Research by the Pattern System," R. L. Davies and George T. Collins, Chem. Ind., June 1945, pp. 949-953.

Presentation of data and lack of data in making expansion decisions; types of decisions; arrangement and classification of information.

Market Research

"How to Utilize Market Research Data in New Product Pricing," Roger Williams, Jr., Chem. Ind., Dec. 1947, pp. 996-998.

Method of integrating new product production costs with market research data to aid management in price decisions and sizing pilot plant and commercial plant; value of market research; production rate vs. profit; ultimate capacity; long range forecasts.

"State Publications for Market Research," R. L. Vormelker, Chem. Ind., Aug. 1947, p. 235.
The use of state bulletins.

"Chemical Market Research—Its Function, Scope and Organization," M. E. Clark, Chem. Ind., Jan. 1947, pp.

Obtaining basic data; sales forecasts; capital expansion programs; new products; techniques; sources of information; presenting and using the report; organization of market research.

"Statistical Analysis and Interpretation of Chemical Market Research Data," Ernest H. Jurkat, Chem. Ind.,

Market Research Data, Ernest H. Jurkat, Chem. Ind., Dec. 1946, pp. 1021-1024.

Basic principles; statistical analysis; interview surveys; collection of data; sample design; relation between employment data and percent production; sampling errors; market estimates; relation between price trends and employment; forecasts.

Pricing and Selling

"New Look at Economics of Pricing," S. C. Schuman,

Chem. Eng., Mar. 1955, pp. 180-182.

Article presents a correlation of prices of chemical products vs. annual quantities produced; relation between demand, supply and price.

"Pricing New Products for Maximum Profit," Roger Williams, Jr., Chem. Ind., Oct. 1947, pp. 622-624ff.

How break-even charts and their variants provide the information necessary for decisions on whether or not to invest, and the price to be charged for a new product. Economic analysis; plant size vs. unit cost: derivation of the break-even chart; % capacity vs. % return on investment.

General Cost Estimation Symposia

"Why the Emphasis Today on Costs," Chem. Eng., Jan. 1953, pp. 167-190.

Symposium of eight articles on cost estimation as

given below.

"How to Estimate Costs in a Hurry," H. E. Wessel,

pp. 168-171ff.

p. 108-17111. Shortcuts which simplify evaluation of economics of a proposed operation at the earliest possible stage; investments and turnover ratios; capital requirements; cost distribution as percentage of manufacturing cost: return on investment.

"When Making Cost Estimates—Watch Your Lan-guage," R. D. Benttie and J. E. Vivian, pp. 172-175. Definitions of various terms used in economic

"Ejectors Show Low First Cost," J. C. Tallman, pp.

General types: Materials of construction; installed costs; cost factors; operating costs; one stage to four stage ejectors considered.

"New Cost Data Bring Economic Pipe Sizing Up to Date," R. M. Braca and J. Happel, pp. 180-187.

Basic efficiency data on pumps; piping; valves and

insulation; economic liquid velocity; economic pipe size; utilities data; cost of pumps, pipe, fittings. Example calculation; correction factors.

"New Correlation of Engineering and Other Indirect Project Costs," J. P. O'Donnell, pp. 188-190. Costs of engineering, design and drafting; con-struction overhead; graphical correlation; factors

affecting indirect costs; costs vs. percentages.

'Data and Methods for Cost Estimation-Part I," Chem.

Eng. Reprint, 1946-1952.
A collection of 38 cost estimation articles from Chemical Engineering. Preliminary cost estimates; freight costs; equipment costs; site location; field fabricated vessels: instrument costs; vibrating screens; pipe and fittings, (installed costs); six tenths factor; total plant costs; ion exchange; turnover ratios; payout time; maintenance costs; labor requirements; power requirements; utilities requirements; pilot plant equipment costs; screw conveyers; vessels; evaporators; towers; pumps; heat exchangers; centrifugals; dryers; fans and blowers; refrigeration units; filters; furnaces; centrifugals. cal Engineering. Preliminary cost estimates; freight

"Data and Methods for Cost Estimation—Part II," Chem. Eng. Reprint, 1952-1953. A collection of 12 cost estimation articles from Chemi-

cal Engineering. Effect of inflation; quick cost estimates; ejector costs; blower and fan costs; mixer costs; engineering and other indirect project costs; economic pipe sizing; operating costs for labor; risk factors; cost control by kilowatts; causes of poor cost estimates.

"Costimating," W. L. Nelson, Oil and Gas Journal

Reprint, 1952.

Cost indexes; exchangers; tanks; construction costs; towers; insulation; depreciation; buildings; motors; electrical; compressors; filters; instrumentation; blowers and compressors; road building; ejectors; vacuum equipment; piping; effect of size on cost of equipment.

"Process Equipment Cost Estimation," Chem. Eng., May

1947, pp. 107-138.

Indexes; building costs; complete plant costs; structural costs; service facilities; site costs; insulation costs; centrifugal separator costs; ejectors and condensers; ammonia plants; spray dryers; freight costs; refrigeration costs.

Labor Cost Indices

"Indirect Wages Ballooning Upward," Factory Management and Maintenance, May 1956, p. 143.
Wage rates for Dalles, Denver, Detroit, Minneapolis,

Minnesota, New Orleans, Philadelphia, San Fran-

"Indirect Labor Still Climbing," Factory Management and Maintenance, Sept. 1955. p. 103. Wage rates for Atlanta, Baltimore, Boston, Chicago, Los Angeles, Memphis, New York, Portland, St. Louis.

Equipment Cost Indices

"No Let Up In Equipment Cost Rise," Chem. Eng., Mar.

1956, pp. 194-195. Marshall and Stevens Index 1913-1955 covering process and related industries.

General Cost Indices

1953-1954.

"Factory's Cost Index of Plant Maintenance," Factory Management and Maintenance, Jan. 1955, p. 160. Building and facilities index, equipment index, labor and materials; annual index 1947-1953, monthly index

"Factory Cost Index," Factory Management and Mainte-nance, Jan. 1956, p. 132.

Building and facilities index, equipment index, labor and materials; annual index 1947-1954, monthly index 1954-1955.

"Factory's Cost Index," Factory Management and Maintenance, Jan. 1954, pp. 113-128.

Building and facilities index; labor and materials index; uses of the cost index annual index 1947-1952, annual index 1953; complete reprints of annual cost index 1947-1953.

Preparation of Cost Estimates

"Symposium on Capital Cost Estimation," Chem. Eng.

Progress, May 1956, pp. 171-178.

Preparation of proposal type estimates; evaluation and proposal type estimates; degree of accuracy; experience factors; uses and limitation of cost charts.

"Preparation of Operating Cost Estimates," E. Roy Sweet, Chem. Eng. Progress, May 1956, pp. 179-182. Operating cost estimates; capital cost estimate; direct costs; indirect costs; fixed costs; miscellaneous costs; total costs; typical operating cost estimate.

"The Importance of Complete and Accurate Capital Cost Estimates," Chem. Eng. Progress, May 1956, pp.

187-190.

Analysis of the discrepancies between profits pre-dicted on economic evaluations and actual profit his-tories; check list of items essential to a capital cost estimate; elements of product cost; effect of capital estimate on profitability.

"Cost Estimating and Decision Making," J. S. Hicks and L. R. Steffans, Chem Eng. Progress, May 1956, pp. 191-194.

Alternatives; error distribution; decision criteria; procedure for obtaining standard deviation of cost estimating procedure; cost of cost estimates; utilization of background information; mathematical analysis; decision theory.

"Short Cut Estimating of Processes," J. F. Gilmore, Jr., Pet. Refiner, Oct. 1953, pp. 97-101. Basic method; principle items; engineering overhead, fee and contingency; factors affecting plant cost.

"Economic Analysis in Petroleum Refining," J. P. Hamilton, Pet. Refiner, Oct. 1953, pp. 102-106.

General function of economic analysis; operating costs; payouts; optimum operation; cost of new products; investments; material balance; justification of new equipment; unit costs.

"Economic Analysis in Chemical Plants," A. B. Horn, F. J. Sergeys and W. C. Strader, Pet. Refiner, Oct. 1953, pp. 107-109.

Basic purposes of economic evaluations; analysis of methods from conception of a new product idea to eventual marketing; manufacturing costs; important cost elements.

"Definitive Cost Estimating," H. Bottomley, Pet. Refiner, Oct. 1953, pp. 110-112. Typical estimating form; procedure; breakdown of

material costs.

"How to Prepare Cost Estimates," H. Bottomley, Pet. Refiner, Sept. 1953, pp. 211-214. Foundation detail sheet; tips on preparing cost esti-

mates for: piping, insulation, electrical, structures, buildings, foundations; contractors expense and profit.

"How to Prepare Preliminary Cost Evaluation Reports," Pet. Refiner, June 1952, pp. 126-130.

A detailed and illustrated procedure for preliminary evaluation type estimates; very specific and excellent guide; cost estimate; profit estimate; production cost

Pavoff Time

"Newest Way to Figure Payoff," Ray I. Reul, Factory Management and Maintenance, Oct. 1955, pp. 92-96.

Profitability of capital investment; profitability index; interest on discount rate; worksheet and graph.

"Solve for Payout Time," E. Yanagisawa, Chem. Eng., Jan. 1955, pp. 185-186.

A nomographic solution for payout time; accounts for changes in tax rates; considers the future value of income, depreciation and investment over the life of the project.

"How to Tell Where You Break Even," Sanitary Mainte-nance, Mar.-April 1949, pp. 24-25. Procedure and examples using a simple chart solution.

Depreciation

"Annual Savings, Return and Depreciation Fix Justifiable Investment," G. A. Larson, Power, Sept. 1955,

Nomographic solution.

"Depreciation Dons a New Look," W. H. Chartener and E. T. Thompson, Chem. Eng., Dec. 1954, pp. 171-174. New depreciation formulas compared with older methods; advantages; disadvantages of each.

"Evaluate Your Depreciation Charges," A. M. Hartogensis and H. D. Allen, Chem. Eng., Feb. 1954, pp. 195-198.

Depreciation; deterioration; obsolescence; typical useful lives for a variety of equipment in a number of processes, given in tabular form; replacement fund.

Site Location

"How to Find Best Site for New Plant," D. V. Bierwert and F. A. Krone, Chem. Eng., Dec. 1955.

Technique presented per units optimum solution in minimum time. Overall analysis; development of potential location cases; evaluation of alternatives; evaluation of tangible factors; correlation and presentation; example worked out.

Effect of Size on Costs

"How Plant Costs Vary With Size," Bryce P. Schofield,

Chem. Eng., Oct. 1955, p. 185.
Graph based on chlorine production plants.

"How Plant Size Affects Unit Costs," S. H. Schuman, Chem. Eng., May 1955, pp. 173-176.

A quantitative analysis of the relationship between plant size and unit costs; capital costs, raw materials costs, labor and other costs, vs. plant size; earnings and selling price; analyzing the results.

Consideration of Alternates

"The Venture Worth Method for Economic Balances," J. Hoppel, Chem. Eng. Phygress, Dec. 1955, pp. 533-539, Information required; the time element; venture worth concept; how to calculate and evaluate venture profit; increased productivity; taxes; applications.

"Analyse Investments With This Tool," F. B. Odasz, Jr., Pet. Refiner, June 1955, pp. 143-147.

Statistical approach a convenient means to evaluate the risk of a proposed investment; payout statement; direct production costs; synopsis of calculations in nomographic form.

"How to Evaluate Alternative Layouts," Factory Management and Maintenance, Feb. 1955, pp. 126-129.
Cost comparison; list of pros and cons, tally of gains and losses: ranking; value rating; factor analysis; rating of objectives; forms presented.

"How Inventory Costs Affect Your Process Economics," H. Schweyer, Chem. Eng., Oct. 1953, pp. 188-192. How storage and interest charges on materials in inventory influence optimum length of run. Semicontinuous operations; batch operations; nonrepetitive operations; in-process inventory.

"General Foods Compares All Costs Before Selecting Plant Equipment," J. F. Forkos, Plant Eng., April 1952,

Sources of supply; elements to be compared when selecting equipment; operating costs; elements of comparison; cost comparison of various pipe sizes gives annual operating costs; comparison of equipment bids.

"Operating Alternatives on Basis of Cost Analysis,"
J. L. Fox, Petr. Refiner, July 1950, pp. 90-94.
Selection of alternatives; buy and sell choices; differential cost and differential income; cost analysis budgets; example applications.

Capitalized Costs

"Capitalized Cost vs. Annual Cost." G. C. Lammers and F. C. Jelen, Chem. Eng., Dec. 1955, pp. 183-184.

Comparison of two methods by solving an example by both methods.

"Replacement Problems; How You Can Get the Best Answers By Using Capitalized Costs," F. C. Jelen, Chem. Eng., Aug. 1955, pp. 181-188. Nomograph for solving capitalization factors; cost of

replacement; annual consideration; considerations of all costs; process replacement; payout time for re-placement; varying annual expense; equipment uni-form yearly cost; interest rate; derivations of equations.

"Next Time Use Capitalized Costs," F. C. Jelen, Chem.

Eng., Feb. 1954, pp. 199-203.
Tables giving factors for capitalization of present costs; compound interest factors; deferred costs; salvage value; non-recurring costs; possibility of obsolescence; cost of abandonment.

Miscellaneous Tools for Cost Estimation

"Guide for Picking the Right Bid," E. E. Ludurg and A. F. Shorkey, Chem. Eng., Jan. 1955, pp. 181-184.

Check list for buying equipment; analysis of bids; how problem breaks down; review of design features; comparison of bids; seller-buyer relationships; evaluation and selection.

"Simplify Your Cost Estimates," L. Lynn and J. R. McKlveen, Chem. Eng., April 1953, pp. 193-195.
Presentation of cost estimates in nomographic forms; examples given.

"Evaluating Economics by Nomograph," R. D. Hill, Pet. Refiner, June 1955, pp. 139-142. Preliminary economic evaluations; economic evalua-

tion nomographs; operating costs; fixed costs; capital investments; auxiliary nomographs; example.

"New Tool for Economic Studies," Chem. Eng., Nov. 1953, pp. 130-132.

Input-output system of portraying the complex buyerseller relationships; purchasing vs. producing; consumer role.

"These Capital Cost Considerations," E. B. Chiswell and J. J. Merrill, Pet. Refiner, June 1954, pp. 127-130.
Corporation tax level; payout period; choice of competing processes; allocation of the money; varying payout period; effect of plant size.

"The Exclusion Chart," H. W. Zabel, Chem. Eng.

The Excusion Chart, H. W. Zabel, Chem. Eng. Progress, May 1956, pp. 183-186.

The use of exclusion chart to determine cost at which a given product must sell in order to be successful in the competitive market; application to several types of chemical industries demonstrated.

Effect of Inflation on Cost Estimation

"Watch Your Cost Analyses," F. C. Jelen, Chem. Eng. June 1956, pp. 247-252.

Equivalent yearly burden; initial cost; the 'I' factor

extended capitalized costs; interpretation of costs; inflation; check list of equations for capitalized cost and equivalent yearly burden; salvage value; deferred costs; an extensive example worked out.

"Consider Inflation in Comparative Cost Analyses," F. C. Jelen, Chem. Eng., May 1956, pp. 165-169. Capitalized costs refer everything to present; initial cost; fixed annual cost; salvage value; half-life of the dollar; deferred costs; equivalent yearly burden.

"What Will Happen to These Earnings," J. D. Joffe, Chem. Eng., April 1955, pp. 195-198.

Operation at reduced capacity; effect of changing selling price; effects of inflation, deflation; comparison. sons; examples worked out in detail.

"Getting at Your Handling Costs," G. A. Smith, Chem. Eng., Feb. 1955, pp. 193-194. Items listed which must be considered in determining handling costs; volume; floor space; equipment; number of operators.

General Equipment Costs

"Cost of Installing Centrifugal Pumps," R. W. Lundeen and W. G. Clark; Chem. Eng., Aug. 1955, pp. 189-190. Cost breakdown; electrical costs; costs of foundations; equipment costs.

"How to Estimate Stack Costs," E. J. Staukiewicz, Chem. Eng., June 1955, pp. 239-244.

Brick stacks; concrete stacks; steel stacks; comparison of initial stack costs; stack elevation.

"How Much for Rubber-Lined Vessels," R. W. Lundeen and W. G. Clark, *Chem. Eng.*, Mar. 1955, pp. 191-194. Cost curves to aid in estimating rubber lined tanks and pressure vessels, the data cover a wide range of sizes and shapes.

"Air Ejectors Cheaper Than Steam," F. Duncan Berkeley, Chem. Eng., Nov. 1954, pp. 164-168.
Factors to be considered; basis of comparison; test results; air consumption of air operated ejectors; costs of air compression; costs of evacuation of various volume; the thermo-compressor.

"How to Estimate Dust Collector Costs," J. M. Dalla Valle, Chem. Eng., Nov. 1953, pp. 177-183.

Costs of various types of collectors, dollars per cfm; weights of various types lb. per cfm.; frame or panel filters; cloth filters; reverse jet filters; water scrubbers; metal mesh; cyclones; mechanical collectors; electrostatic and sonic collectors; collectors, to the contraction of the collectors of the collectors. electrostatic and sonic collectors.

Pipe Costs

"How to Figure Pipe Costs," R. A. Dickson, Power, Nov. 1950, pp. 80-83. Brass pipe; cast iron pipe; Duriron; glass; lead pipe; porcelain, steel, rubber lined; pre-insulated.

Electrical Costs

"Rough-Cost Figuring for Distribution Equipment," Power, Feb. 1956, p. 128. Power transformers; metal-clad switch gear; distribution cable.

"Fast Estimate for Power Plant Costs," T. A. Fernside and F. C. Cheney, Chem. Eng., June 1953, pp. 239-241.
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Calculate Fluidized Heat Transfer by

Here's a quick route to estimates of heat transfer coefficients in dense-phase fluidized beds. Save calculation time with these charts.

CHIN-YUNG WEN and LIANG-TSENG FAN, West Virginia University, Morgantown, W. Va.*

Fluidized beds offer many advantages over other conventional methods for solid-gas contacting. Outstanding are temperature uniformity in the bed and rapid rates of heat transfer.

This may be due to vigorous agitation of the solid phase and to a high heat capacity of the particles, preventing rapid local changes in temperature.

Design of a fluidized unit often requires estimation of heat transfer coefficients. Although much work (see references) has been done on heat transfer between the fluidized bed and the wall for internal as well as for external heating and cooling, so far we have no general correlations available.

In this article we offer a brief nomographic method for estimating heat transfer coefficients for dense phase fluidized beds when operating under a wide range of conditions.

This Is the Basis

Our nomographs are based on the generalized equation recently proposed by Wen and Leva," who re-

* Meet your authors on p. 315.

Nomenclature

- C. Solid particle heat capacity, Btu./lb.-°F.
- D_{ν} Particle diameter, ft.; but for Eq. (3) and nomograph use in.
- E Fluidization efficiency
- g Gravity constant, ft./hr.
- G_t Gas mass velocity, lb./sq. ft.-hr. G_{mt} Minimum gas velocity for fluidization, lb./sq. ft.-hr.
- h Heat transfer coefficient, Btu./ hr.-sq. ft.-°F.
- k Thermal conductivity of gas, Btu./hr.-ft.-°F.
- R Bed expansion ratio
- pr Gas density, lb./cu. ft.
- ρ. Absolute solid particle density, lb./cu, ft.
- β Gas viscosity, lb./hr.-ft., unless otherwise specified. Nomographs and Eqs. (3) and (4) use centipoises.

correlated the major available dense-phase heat transfer data based on a proposed heat flow mechanism. According to this mechanism of heat flow between a confining wall and a fluidized bed, the main resistance to heat flow is through the laminar layer adjacent to the vessel boundary.

Accordingly, as the particles sweep along the heat transfer area, the thickness of the laminar fluid layer will be reduced due to the scouring action of the particles. Then, as the bed continues to expand as a consequence of increasing gas rate, the increase in heat transfer coefficient continues.

However, the rate of increase in heat transfer coefficient becomes progressively smaller since the concentration of particles next to the wall will decrease. This leads eventually to a maximum heat transfer coefficient beyond which the operation is known as dilutephase fluidization.

A Proposed Equation

The proposed dimensionless equation of Wen and Leva gives estimated values of heat transfer coefficient, h, that agree well with most data reported in the literature. Accordingly,

$$\begin{array}{ll} hD_p/k &= 0.16 (D_p{}^{1.5}C_s\rho_s g^{0.5}/k)^{0.4} \times \\ & (D_pG_fE/\mu R)^{0.36} \end{array} \ \ (1) \end{array}$$

For practical purposes we can cancel D_r and simplify to:

$$h = 0.16g^{0.3}k^{0.4}(C_*\rho_*)^{0.4}(G_fE/\mu R)^{0.36}$$
 (2)

Eq. (2) is supported by extensive data pertaining to such solid particles as carborundum, iron oxide, coke, Devarda's alloy, fly ash, iron powder, lead, cracking catalyst, Scotchlite glass beads, alumina and various kinds of sand. Particle size ranged from 0.002 in. to 0.015 in., as an average diameter. The equation is supported by data obtained from these gases: air, hydrogen, helium, argon, carbon dioxide and methane. Gas flow rate

ranged from 2 to 1,000 lb./sq. ft.-

In evaluating heat transfer coefficients using this equation, the minimum gas velocity required for fluidization, G_{mt} , the fluidization efficiency, E, and bed expansion ratio, R, must be known as well as the properties of the fluidizing solid particles and gases.

To Estimate Minimum Gas

To estimate the minimum gas velocity required for fluidization, G_{mf} , we can use a correlation that was proposed by Leva, Shirai and Wen.⁶ For situations where $D_p G_{mf}/\mu$ is smaller than 5:

$$G_{mf} = 688 D_p^{-1.42} \frac{[\rho_F(\rho_e - \rho_F)]^{0.94}}{\mu^{0.88}}$$
 (3)

where D_p is the particle diameter in inches; and μ is gas viscosity in centipoises.

This correlation is valid for vesicular and nonvesicular materials as well as for both gas- and liquid-phase fluidization through the entire region from laminar to turbulent flow.

You can use Fig. 1 for rapid estimation of G_{mf} when D_p G_{mf}/μ is smaller than 5. Connect gas viscosity in centipoises through the scale of ρ_p $(\rho_r - \rho_p)$ and locate the intersection on the reference line. Connect the point of intersection with the particle diameter scale and find the minimum gas velocity for fluidization on the G_{mf} scale, which is in lb./hr.-sq. ft.

Use Correction Factor

Now calculate D_p G_{mf}/μ and if this value is larger than 5, correct the value of G_{mf} by a factor that can be obtained from Fig. 2. Multiply the factor from Fig. 2 by the value of G_{mf} picked off the nomograph, Fig. 1, to get the correct minimum gas velocity required for fluidization. With the exception of extremely high beds, this value

Nomograph

of G_{mf} is valid for varying bed heights.

For Fluidization Efficiency

Fluidization efficiency is defined by:

$$E = (G_f - G_s)/G_f$$

where G_{\circ} is the gas mass velocity that would be required if the bed were merely fixed (and not fluidized) and having the same average void space and the same pressure drop.⁶

To evaluate fluidization efficiency, use Fig. 3. Reduced gas mass velocity, G_t/G_{mt} , is plotted against fluidization efficiency, E, with particle diameter as parameter. With the minimum gas mass velocity for fluidization now known from Figs. 1 and 2, you can now calculate G_t/G_{mt} . Fluidization efficiency is then read from Fig. 3 at the corresponding particle diameter.

Bed Expansion Ratio

Bed expansion ratio, R, is the ratio of bed height after expansion to that before expansion and is obtained from Fig. 4.

Fluidization efficiency and bed expansion ratio were reported as being closely related to particle velocity in the bed, a parameter that appears to be linked to film coefficients.

Now, Transfer Coefficient

We can now evaluate heat transfer coefficients from Fig. 5, if we know solid and gas properties. Thus,

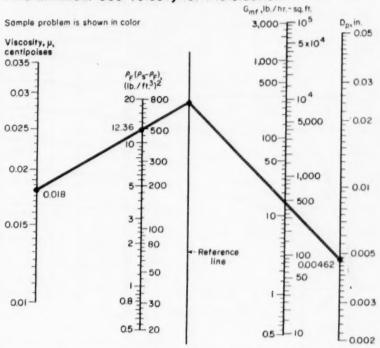
$$h = 8.45k^{0.6}(C_s\rho_s)^{0.4}(G_fE/\mu R)^{0.36}$$
 (4)

which is a slightly different form of Eq. (2), with viscosity expressed in centipoises for greater convenience.

In using Fig. 5, calculate $G_{\ell}E/\mu R$ first. Then evaluate $C_{\ell}\rho_{\ell}$ with C_{ℓ} in Btu./lb.—°F., and with ρ_{ℓ} in lb./cu. ft. Since we usually know the thermal conductivity of the gas, k, we obtain the heat transfer coefficient this way:

1. Connect the value of (G, E)

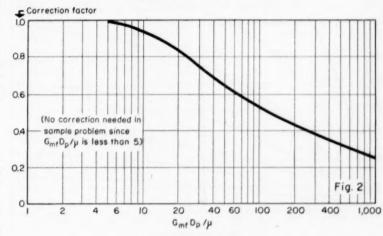
Find Minimum Gas Velocity for Fluidization



Note: Left (or right) scale of $\rho_F(\rho_S^-\rho_F)$ corresponds to left (or right) scale of G_{mf}

Fig.1

But You May Need This Correction Factor



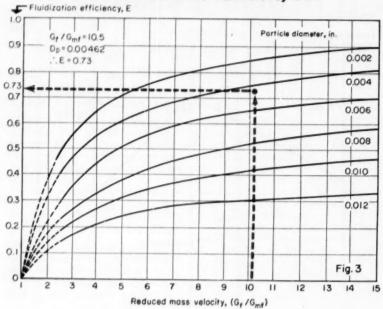
 $(\mu \ R)$ with C, ρ , and a point on the reference line.

2. Connect the point on the reference line with k and extend to the h scale where the heat transfer coefficient can be read in Btu./hr.-sq. ft.-°F.

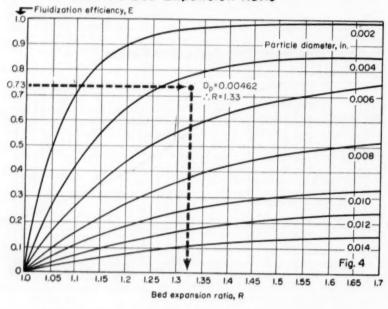
This method applies to either

heating or cooling of fluidized beds to the confining wall. For densephase bed-interior heat transfer, the coefficients are generally considerably higher than for bed-wall systems, particularly at lower gas rates. This is due to the difference in internal-solids and gas flow pat-

Then Estimate the Fluidization Efficiency • • •



••• and Get the Bed Expansion Ratio



tern. Particle movement is predominantly upward in the center of the vessel and less vigorously downward near the wall.

For most practical purposes, the internal heat transfer coefficient can be approximated by:

$$h_i/h_s = 9G_f^{-0.87}$$
 (5)

where subscripts i and e refer to internal and external, respectively.

Sample Problem

Problem—Alumina powder is poured into a brass cylinder of 5.5-in. I.D. and 22-in. high until a bed

height of approximately 10 in. is attained. Air is admitted into the base of the column through a perforated plate. The bed is internally (centrally) heated by an electric cartridge heater. The wall of the brass cylinder is water-jacketed for cooling.

Estimate the heat transfer coefficient for heat flowing from:

 The fluidized bed to the cylinder wall.

• The centrally located copper tube heater into the bed.

Operating conditions are as follows: For alumina, absolute density is 167 lb./cu. ft.; bulk density is 64 lb./cu. ft.; particle heat capacity is 0.19 Btu./lb.-°F.; and particle diameter is given as 0.00462 in.

For a narrow-cut solid such as alumina with d_1 and d_2 representing adjacent sieve openings, geometric mean particle size is suggested. Thus.

$$D_p = (d_1 d_2)^{0.8}$$

For air assume that the flow rate is 158 lb./hr.-sq. ft.; the temperature is 75 F.; and the pressure is 15.0 psia.

And Its Solution

Solution—First we'll estimate the minimum gas velocity required for fluidization. The viscosity of air at 75 F. is 0.18 centipoises; and the density is 0.074 lb./cu. ft. Therefore,

$$\rho_F(\rho_* - \rho_F)$$

is approximately equal to

 $\rho_F \rho_s = 0.074(167) = 12.36 \text{ (lb./cu. ft.)}^2$

From Fig. 1 for $D_p = 0.00462$ in., $G_{mf} = 15$ lb./sq. ft.-hr. No correction factor is needed since $G_{mf}D_p/\mu$ is less than 5.

Next we estimate fluidization efficiency, E. Reduced mass velocity, $G_{l'}G_{ml}=10.5$. Then, from Fig. 3, E=0.73.

We can estimate the bed expansion ratio, R, from Fig. 4. Bed expansion ratio is about 1.33.

Now, we are ready to estimate the heat transfer coefficient, h:

$$G_f E/\mu R = (158)(0.73)/(0.018)(1.33)$$

= 4,818

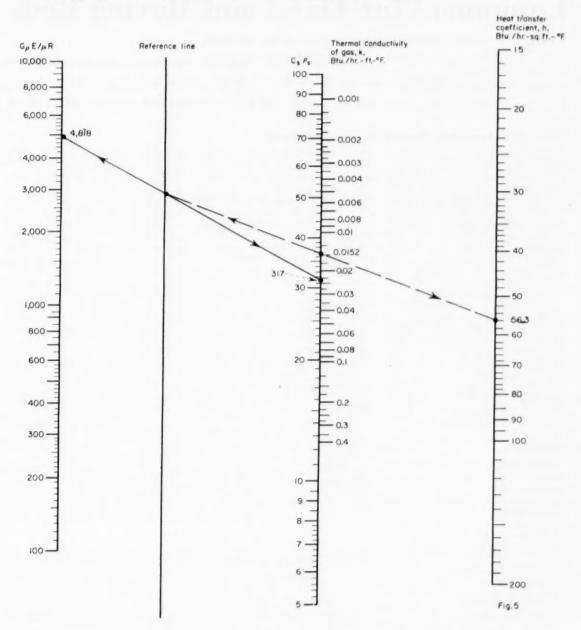
$$C_{s\rho_{\bullet}} = 31.7 \ \mathrm{Btu./cu.\ ft.}^{\circ}\mathrm{F.}$$

 $k = 0.0152 \ \mathrm{Btu./hr.}^{\circ}\mathrm{F.}$

From Fig. 5, we can get the wallbed heat transfer coefficient,

 $h_{\bullet} = 56.3$ Btu./hr.-sq. ft.-°F. and the internal heat transfer coefficient from Eq. (5):

This Nomograph Gives the Coefficient for Fluidized Heat Transfer



 $h_i = (56.3) (9)/158^{6.87}$ $h_i = 77.8$ Btu./hr.-sq. ft.-°F.

In this example, we have taken values from the experiments of Baerg, et al. They reported a minimum gas velocity of 15 lb./hr.-sq. ft. and an internal heat transfer coefficient of 73.2.

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Equipment for Fixed and Moving Beds

Here are the practical equipment considerations for fixed and moving beds—how and where they are used, what materials are applicable and how packings and supports affect them.

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Next in this series are three articles which discuss primarily flow of a single phase through various types of fixed and moving beds. Here the term fixed bed is intended to denote that the bed voidage remains essentially constant for varying flow rates. This limitation distinguishes the fixed bed clearly from the fluidized bed, in which bed voidage is a function of flow rate. In another type of bed, the moving bed, the entire charge descends through the vessel, very much in piston-like manner. In general there is no over-all voidage variation due the downward motion. Nor will the flow rates affect the over-all bed voidage in this case, either. In a sense, a moving bed constitutes a special case of a fixed bed. Hence, flow through the moving bed will be considered along with conventional fixed beds.

Fixed Beds

The simplest type of fixed bed consists of a single compartment. Essential components of construction, as indicated in Fig. 1, comprise a shell, a bed support and the bed itself. Fluid flow is predominantly downward, although upward flow is possible under special conditions.

The flow chamber of Fig. 1 is a single-compartment fixed bed and is the basic design of a great number of important units, serving the process industries on a wide scale. Without attempting to give a complete listing, this construction is used in the following cases:

- Ab- and adsorptive dryers for liquids and gases.
- 2. Ion exchange chambers.
- 3. Solvent recovery operations.
- 4. Towers bringing about physical or chemical changes.
- 5. Gravity filters.
- 6. Catalytic reactors.

* Meet your author on p. 216,

The first three operations are quite closely related to each other, hence they use similar equipment.

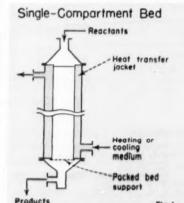
In adsorptive dryers, gases or liquids carrying water vapor or dissolved water are passed downward through beds of silica gel, activated alumina or other adsorbents and the water component is condensed within the adsorbent. After a certain amount has been adsorbed the adsorbent becomes saturated and the flow is shifted to a second tower, while the first unit is reactivated by application of heat, or vacuum, or both. Ion exchange units treat water or other liquids by passage through special ion exchange resin beds. The resins are usually in granular form, contained in a dual tower system. One of the towers will be on stream while the other is undergoing regeneration for continuous operation.

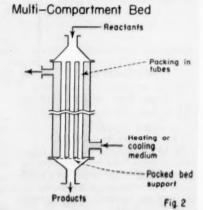
Solvent recovery systems comprise several unit operations. The first step is of interest here because it involves contacting solvent-laden gases with activated carbon or similar adsorbents. During pasage the solvent is condensed on the adsorbent until it becomes

saturated and the unit is then shifted to regeneration.

Fixed beds are of course used extensively in bringing about physical or chemical changes. An example of the first is leaching operations, where solution of certain components occurs. Also important are contacting towers where chemical combination takes place between a solid and one or more components of a gas or liquid stream. A typical example is the old iron oxide box, where hydrogen sulfide is removed from sour gases by contacting with certain oxides of iron.

Fixed beds are also used extensively in filtration. Probably the most important application is in municipal and industrial water treatment, where the water flows through graded sands and gravel. These units remove various suspended matter, and their capacity therefore decreases as operation proceeds. Periodic regeneration of the full flow capacity is usually accomplished by backwashing. Since this requires reversing the flow—which leads to bed expansion—this operation is related to fluidi-





How the Series on Packings and Beds Is Organized

Random Packed Towers

Gas-liquid systems Liquid-liquid systems

Stacked Towers

Gas-liquid systems

Reactors

Fixed and Moving Beds

 Equipment Variables in the system Correlations

Fluidized Systems

zation and so will be discussed in a later article in more detail.

Single-compartment fixed beds are also used as catalytic converters. However, applications of this sort are more or less limited to the laboratory or pilot plant operations. On a relatively small-scale, single-compartment reactors are quite useful for catalytic kinetic studies. In large-scale operations, single-compartment fixed beds are usually not feasible because catalytic reactions almost always require transfer of substantial quantities of heat, which often is not possible through beds of considerable diameter. For this reason, when fixed beds are used in commercial catalysis, tubular or partitioned vessels are generally employed.

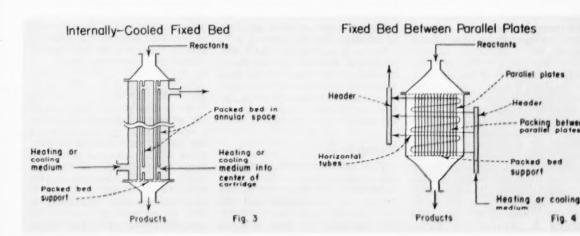
Some typical tubular or partitioned constructions are indicated in Figs. 2 and 3. Fig. 2 shows a typical tubular unit consisting of a tube bundle between two tube sheets, a shell and two adjoining heads. Here the catalyst is inside the tubes, held in place by a suitable screen over the lower tube sheet. A heat-transfer medium con-

tacts the outside the tubes. In essence, a reactor of this type is a parallel assembly of the already discussed single-compartment fixed bed. Obviously, it is most important that in a reactor of this type each tube be charged with as nearly as possible the same amount of catalyst. If there are substantial variations in bed density, some tubes will operate under different space velocities than the others. This may affect the yields and product distribution and generally lead to unsatisfactory performance. The tube diameter and layout of the tubes are also of fundamental importance from a performance standpoint. These considerations are largely dependent on heat of reaction, operating temperatures and overall heat transfer coefficients to be expected from the particular system.

The catalyst is usually on the inside when the heats of reaction are substantial and when high coefficients on the packed-tube side are required. With the heat transfer medium on the outside it is most convenient to maintain the coolant either at the boiling

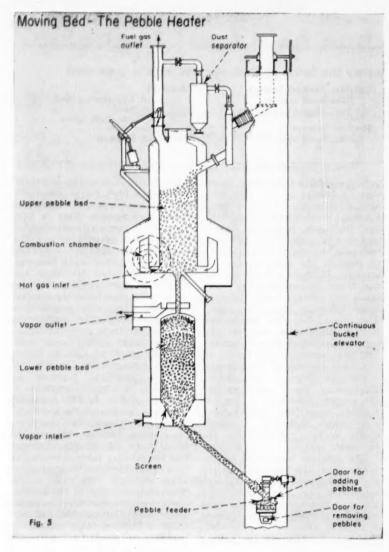
point or, if it must be below, to maintain a high liquid film coefficient by a brisk rate of circulation. When less reaction heat is produced, it is frequently satisfactory to place the catalyst around the tubes and circulate the liquid inside. Usually this leads to somewhat smaller shell diameters and also to a more uniform catalyst bed density than when the catalyst is inside. There may, however, be serious difficulties in discharging the catalyst from such vessels.

Occasionally, with very heatsensitive reactions such as hydrocarbon synthesis by the Fischer-Tropsch reaction, it may be desirable to employ reactors of the type of Fig. 3. This construction also uses vertical tubes between tube sheets, but the tubes are modified by inserting an additional tube of smaller diameter into the primary tube. The smaller tube communicates with the coolant space through two short ducts. The catalyst is now in the annular space and the cartridge is cooled from both the outside and the inside. Although this reactor is probably quite satisfactory from a



Packing between parallel plates

Fig.



heat-transfer standpoint, it has some serious drawbacks. These include the considerable expense of construction, a limited catalystholding capacity, and the difficulty of loading the individual tubes evenly with catalyst.

A more reasonable construction for highly heat-sensitive reactors is indicated in Fig. 4. This reactor consists of a bundle of vertical, parallel plates pierced by an essentially horizontal bank of tubes carrying the heat-transfer medium. The parallel plates, thus act as fins for the tube banks, which carry the heat transfer medium. The catalyst is between the plates.

With this type of construction it is obviously not desirable to have a boiling coolant as the heat reservoir. The distance between plates depends on the heat of reaction, operating temperature, tube bundle spacing, thickness of the plates and the thermal conductivity of the metal.

Moving Beds

The basic elements of a movingbed system consist in the main of three parts. These are the reactor proper, the regenerator and the solids conveying mechanism. From the character and uses of these parts the purpose of the moving bed becomes clearly obvious. In contrast to the dual-tower system where contacting is intermittent, the moving bed renders the operation continuous.

A description of moving-bed components and processes utilizing the moving bed has been given by Berg. He has also given an account of methods of solids lifting under a variety of conditions. Besides the processes described by Berg, the moving bed also finds application in the so-called pebble heater. Details of such a system' are given in Fig. 5. A pebble heater is a heat transfer unit in which heat passes directly from hot, substantially spherical solids -pebbles or similar bodies-to ambient gases or vapors. Apart from a number of important special requirements which the solids must meet, a high specific heat is probably most essential, since the heating capacity of the unit is directly related to the heat stored in the solids

In practice, the pebbles are usually brought up to temperature by direct contact with hot flue gases in the regenerator. The hot solids then descend to the heat transfer unit where they contact cool gases or vapors. The cooled solids discharge at the bottom and are mechanically lifted to the top of the regenerator, where the cycle is repeated. A pebble heater of this type is thus two moving beds in series. Given sufficient contact time, a thermal equilibrium will be reached in both beds. Pebble heaters have also been designed to operate with only a single fixed bed. The operation is then intermittent and equilibrium conditions are not achieved. Better continuity has been found to result from the use of two fixed beds, with alternating heating and regeneration cycles, rather than a moving bed.

Shapes of Solids

As already pointed out, spherical or nearly spherical solids are preferred in pebble heaters. There are several valid reasons for this. First of all, spherical solids are more easily transported mechanically, as is required in moving beds. There will also be less abrasion and particle breakdown, as well as mechanical wear on the equipment, than when other shapes

are used. Finally, a spherical shape will pack a maximum mass into a minimum volume. Hence, spheres permit a maximum amount of heat to be stored in the packing, a requirement which directly affects the economics of the pebble heater.

With other types of contacting units, the need for a specific shape is somewhat less emphatic than for pebble heaters. However, special shapes were developed originally to improve the reproducibility of operation and the economics of solids-fluid contacting equipment. The earliest solids used were of course granules. However, since "granules" of a given material may vary widely in shape it is not surprising to find that columns packed with granules may give rise to widely differing performances.

Relatively poor reproducibility characteristics of granule-packed columns comes primarily from the considerable variation in bed voidage that may result. Other difficulties that may arise with granules are non-homogeneous packing densities and excessive particle breakdown. Variation in voidage leads to appreciable differences in pressure drop, while non-homogeneous bed density and particle breakdown induce fluid channeling.

The earliest special shapes were probably spheres. In contrast to granules, spheres produce relatively reproducible bed voidages and, as should be expected, fairly homogeneous bed densities. Furthermore, granules yield the highest bed voidage of any particle shape except rings. Spheres, on the other hand, produce much denser beds. The chief objection to a bed composed of spheres is of course the unfavorable ratio of surface area to solid volume. In an attempt to improve this feature, development has shifted to cylindrical pellets. shape most frequently used has an aspect ratio of height-to-diameter of unity. The ends are not wholly flat, but curved slightly outward. Cylindrical pellets can be produced by extrusion, which greatly favors their wide use and economy.

As we have already learned from the discussion of packed-bed units, the packings just discussed may be used in a number of ways. When intended for catalytic reactors, the particles themselves usually act as a so-called catalyst support. The particle material is commonly catalytically inactive. It is either coated or impregnated with catalytically active substances. If activation involves merely coating, then the reaction proceeds primarily on the outside gross particle surface. However, with impregnation, the intent is to make use of a part of the internal surface area of the particles.

For coating, non-porous substances may be used, although some outside surface roughness is desirable so that the active ingredient will effectively adhere to the particle surface. In the case of impregnated-type catalysts, internal porosity is necessary. internal porosity may be very appreciable. Particles of this type are known as vesicular particles. Generally speaking, the internal porosity is not active in providing flow paths for the fluid, but the internal surface area is nevertheless valuable since mass transfer into the interior of vesicular catalysts is primarily by diffusion.

Under all circumstances of operation the bed must be homogeneous in texture, with the voidage as uniform as possible throughout to preclude channeling.

Flow Through Porous Plates

Catalysts and broken solids in reactors are usually supported by means of screens with openings such that the partcles will not materially reduce the fraction of free space in the screen. This is simply achieved by selecting a screen with holes many-fold smaller than the catalyst particles. In general, it is desirable to have a screen of at least as much free space as the particle bed. In most cases this is readily accomplished and the pressure drops attending flow through such a support can usually be neglected.

Sometimes, however, it may be desirable to use porous plates instead of screens. The porous plate will not only support the particles above it, but it will also aid in distributing the fluid into the bed. This is achieved at the expense of a relatively high pressure drop compared to metallic woven screens, perforated plates or similar devices. It is therefore worth while to discuss flow through porous plates in this connection.

Most porous plates are made by bonding finely granular materials together at their points of contact. It is unimportant to this discussion what material of construction and method of bonding is chosen. The important end result is that the porous plate is a consolidated porous medium. In this respect it differs fundamentally from a packed bed which is a non-consolidated porous medium. Consolidated and unconsolidated particles are shown below. Viewed superficially there seems to be little difference between the two formations, except that with the unconsolidated medium the particles are individuals, whereas in the consolidated structure the particles are still discretely recognizable, but are merely sintered to each other. It is therefore surprising to find that the correlations that so well describe flow through fixed beds do not satisfactorily carry over to consolidated media.

As Carman pointed out, pore textures in consolidated media seem more complex than those encountered in granular beds of about the

Consolidated Particles



Non-consolidated Particles



same particle size. Pressure drops through consolidated media are higher than through beds of nonconsolidated particles of equal height and approximately the same size. This may be due to greater tortuosity of flow. Hence correlations of pressure drop data have been largely empirical and equations of the Kozeny-Carman type do not seem to give consistent results.

An approach toward correlation in a greatly simplified consolidated system has, however, recently been suggested by Brownell et al.4 Investigating flows through consolidated media composed of uniform spherical particles bonded together by resins, they defined an "effective voidage" of the consolidated medium and were then able to correlate pressure drops by a friction factor-Reynolds Number plot. The effec-

tive voidage of this system was a simple function of the total voidage. On further study this method may turn out to be promising for extension to consolidated media composed of non-spherical particles.

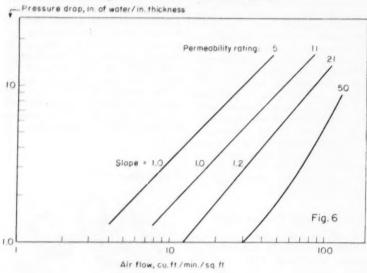
At present, porous plates and their ability to pass fluids are defined by a so-called "permeability rating." This rating is defined as the number of cubic feet per minute of air at 70F, and about 25% relative humidity which will pass through a plate of 1-in. thickness and 1 sq. ft. surface, when the differential pressure across the plate is 2 in. of water column.

Typical data for flow of air through dry Aloxite plates is given in Fig 6. If the plates should be submerged in water their resistance to air flow would be incomparably higher. Data for flow of water through Filtros plates are given in Fig. 7. As the grade becomes finer the permeability decreases.

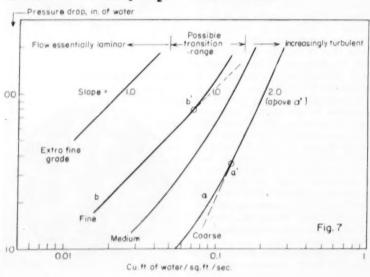
The slopes of the data of Fig. 7 are interesting. If the average pore size as given by the manufacturer is taken as indicative of the "diameter of the flow channel" it may be shown that point a' of Curve (a) corresponds roughly to a Reynolds Number which, in flow through non-consolidated media, would result in turbulent flow. Similarly the Reynolds number at b' would probably result in flow in the transition range. For the extra fine grade the flow is apparently entirely in the laminar flow range as seems indicated by the slope of unity. The slope of 2.0 in the part of Curve (a) above a' might indicate turbulent conditions.

A discussion of pressure drop through porous plates does not resolve all the problems connected with diffusers. It is well known that bubble size and the state of subdivision of gases issuing from porous plates into liquid columns are characteristic of the plate construction. This important flow phenomenon is merely mentioned in passing, since no fundamental relations have so far been achieved in this region.

Air Flow Through Iin. Thick Aloxite Plates



Water Flow Through 1% in. Filtros Plates



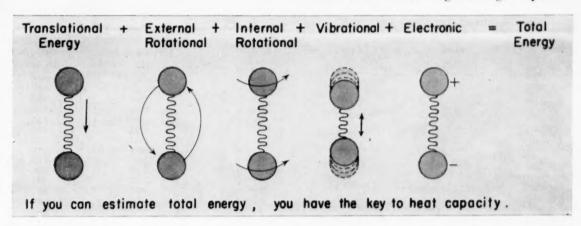
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York, 1956.

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Predict Liquid Heat Capacities

Perhaps you have a file crammed full of heat capacities or a competent central research library at your beck and call. If not, here are calculation methods you can use—gathered in one place for the first time.

WALLACE R. GAMBILL, Union Carbide Chemicals Co., Charleston, W. Va.*

Heat capacities of liquids don't vary much; C_P for a great majority lies between 0.4 and 0.5 Btu./lb.- $^{\circ}$ F., with water and ammonia having unusually high values, and mercury and chlorinated compounds unusually low ones.

Also, since the temperature range for a liquid phase is relatively small compared with that possible for the corresponding vapor, the problem of choosing an approximate value for a liquid is further reduced.

For nearly all liquids, heat capacities rise with temperature increase; only a very few exceptions (such as mercury and rubidium) are known. We've shown previously (Chem. Eng., May 1957, p. 263) the temperature dependence of heat capacities for several common heat transfer media.

The effect of pressure on C_F of liquids is quite small—except near the critical region—and may be roughly approximated from generalized relations to be treated later. Bridgman has shown ["The Physics of High Pressure," G. Bell

& Sons, Ltd., London (1949)] that C_r at first decreases with pressure increase, passing through a minimum at approximately 2,500 atm. and at about 90% of its initial value. Then C_r increases somewhat irregularly but doesn't return to its initial value below 11,500 atm.

 $C_{\rm r}$ behaves similarly, but the minimum tends to arrive at lower pressures and at higher fractions of the initial value. Subsequent increase of $C_{\rm r}$ beyond the minimum usually takes $C_{\rm r}$ at 11,500 atm. to something more than its atmospheric value. These qualitative observations are based on measurements of 12 liquids and apply only to over-all, general trends.

For many normal substances, C_{VL} is approximately equal to C_{VQ} .

Methods for Pure Liquids

We have already discussed, in the section on thermodynamic relations, the general method for calculating the heat capacity of a liquid from C_F of its vapor. Hougen and Watson' have published two generalized charts that facilitate the analytic computation.

Other specific methods for estimating the heat capacities of liquids are those of Sakiadis and Coates, Chow and Bright, and Kopp.

Method 1-Sakiadis and Coates

Calculations of heat capacities of gases in the ideal state, from spectroscopic frequency measurements, began to appear in the literature during the early 1930's.

Methods used are based on the principles of statistical mechanics, which are treated fully in works such as "Statistical Thermodynamics" by Mayer and Mayer. Later developments indicate that the fundamental spectroscopic data for individual substances can be generalized with reasonable accuracy, so that with a knowledge of only the molecular structure—and without direct spectroscopic measurements—we can make the same calculations.

But all this work was related to the gas state alone and we will discuss it further when we come to the section on gases. First, let's consider how this same approach can be applied to the liquid phase.

^{*}Mr. Gambill is now with the Union Carbide Nuclear Co., Oak Ridge, Tenn. To meet your author see Chem. Eng., Feb. 1957, p. 324.

How Molecular Vibration Contributes to the Total Heat Capacity - Table I *

Bond	Stretching, www, cm	Bending, ω _B cm⁻¹	Bond	Stretching, wu, cm.	Bending, wa,cm."	
Э с −н	2,960	contro	c N	900	370	
- c <#	_	1,450	- c≡n	1,620 2,250	845	
- c < Ħ		1,000	C — S C — S ≥ C — F	650 1550 1,100	330 530 530	
> c < #	-	1,450	≥ C-CI	650 500	330 260	
> C −H	3,020	_	0-н	3,400	. 1,150	
= c < #	_	1,100	> N-H	3,350	1,320	
≡ C − H	3,300	700	N = 0	1,700	390	
c c	900	370	N N	990	390	
c = c	1,650	-	S H	2,570	1,050	
C ≡ C C − C = C C − C = C	2,050	600	s — s	500	260	
c = c = c	-	350				
c = 0	1,700	205 390	 Values are taken from Sakladis and Coates; Herzberg, and Stull and Mayfield 			

Sakiadis and Coates' modified this approach and applied it, with excellent accuracy, to the liquid phase. The method can be used to calculate both C_{ν} and C_{ρ} of organic liquids, as a function of temperature, from generalized spectra data and the velocity of sound. Deviations at 68 F. for 100 organic liquids were 1.5% average and 4.0% maximum. Deviations for seven organic liquids at a total of 50 temperatures, ranging from -184 F. to 266 F., were 2.44% average and 7.7% maximum. Agreement was best at higher temperatures.

The general approach involves classification of the total energy of a molecular or atomic complex into its component groups: translational, external rotational, internal rotational, vibrational and electronic.

We'll neglect electronic energy in this treatment since it's not significant except at very high temperatures (usually 900 K. and above). In any event, its evaluation requires detailed spectroscopic data.

For three of the contributions to total energy—translational, internal rotation and external rotation—we can use this evaluation expression for temperatures greater than about 300 K.:

 $(C_r)_{\text{trans. and rots.}} = (6 + n_r') R$ (1) where n_r' is the number of single bonds about which groups of atoms are free to rotate, taken by Sakiadis and Coates to be only (C—C) bonds for liquids; R is the molar gas constant; and note that

the correlation is made for C_r , not C_r .

The remaining contribution to total heat capacity is that of vibration. It's assumed that a particular type of bond possesses two characteristic fundamental frequencies that are independent of the nature of the molecule in which the bond occurs. These frequencies, denoted in Table I above in wave numbers by ω_ν cm. ⁻¹ and ω_ν cm. ⁻¹, are known as the stretching or valence frequencies and the bending or deformation frequencies, respectively.

These frequencies are substantially independent of temperature and are usually somewhat smaller than the corresponding values used for the gaseous state. Values in Table I were taken by Sakiadis and Coates from Herzberg' and Stull and Mayfield.4 In some cases the values were altered slightly after being checked with experimental data. Dotted arcs in the table indicate the type of bending vibrations involved. Since spectroscopic data differentiate between these types of bending, there are two types of stretching for the C-H bond and four kinds of bending. This is why some numbers appear in one column of the table but not in both for this particular bond.

Sakiadis and Coates use this final expression for C_v of a liquid:

$$C_{V} = (6 + n_{r}') R + \sum_{i} q_{i} f_{Bri} + \left(\frac{3n - 6 - n_{r}' - \sum_{i} q_{i}}{\sum_{i} q_{i}}\right) S \sum_{i} q_{i} f q_{i}$$
(2)

where $C_v =$ molar heat capacity of the liquid at constant volume, Btu./lb. mole-°F.; R = 1.9872 Btu./lb. mole-°R.; $n_i' =$ number of C-C bonds in molecule; n = number of atoms in molecule; $\Sigma q_i =$ total number of bonds in molecule; S is a correction factor, a function of compound type and molecular weight $f_{B_{ij}} =$ contribution to heat capacity from stretching vibrations of the i-th bond; and $f_{BB} =$ contributions to the heat capacity from bending vibrations of the i-th bond.

The bracketed expression in the last term accounts for the remaining degrees of freedom which had not been considered previously. It's assumed that they make the same contribution to the heat capacity as the known bending vibrations. The factor S corrects for most of the error in this assumption and Sakiadis and Coates found it to be temperature-independent and a function of only molecular weight for a given chemical series.

Fig. 1 gives the graphical correlation for S as proposed by Sakiadis and Coates. For convenience, we have replotted the several curves on the same coordinates.

Summation terms for stretching and bending can be evaluated by summing the products of the number of a particular type of bond in a molecule by its respective Einstein function, which is a function of the wave number, ω , and absolute temperature, T. In Fig. 2 we show f_x/R as a function of u, where $u=2.585 \, \omega/T$ when T is in deg. R.;

or where $u=1.4384 \omega/T$ when T is in deg. K. A table equivalent to Fig. 2—and more suitable for exact calculations—appears, among other places, in the appendix of Pitzer's book, "Quantum Chemistry," Prentice-Hall, Inc., Englewood Cliffs, N. J. (1953).

The original function for f_B on which tables and graphs are based is as follows:

$$f_B/R = u^2 e^u/(e^u - 1)^3$$
 (3)

where u is as defined above.

Step-by-Step Procedure

Now we can summarize the stepby-step procedure for estimating heat capacity using the method of Sakiadis and Coates:

1. Calculate C_v from Eq. (2) and Figs. 1 and 2.

2. Calculate the ratio of C_P to C_Y as a function of C_P from this equation:

$$C_P/C_V = 1 + \frac{T \beta^8 U_s^3}{25,000 C_P}$$
 (4)

which was derived from:

$$C_P - C_V = T \, \beta^2 / K_T \, \rho \, J$$

and

$$K_T = (C_P/C_V) g_e/U_e^2 \rho$$

In Eq. (4), $T=\deg$. R.; β is the volumetric coefficient of thermal expansion, 1/deg. F.; and U_* is the velocity of sound, ft./sec. The coefficient 25,000 in the denominator is the product of J (778) and g_* (32.17).

3. Substitute C_r from Step 1 into Eq. (4) of Step 2 and solve for C_r .

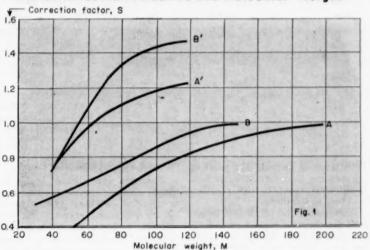
Sample Calculation

Although it is not our usual practice in this series of articles, we think it would be worthwhile to show how the Sakiadis and Coates method works out for a specific case. Let's estimate the heat capacity of n-heptane, C₇ H₁₆, at 68 F.

This corresponds to T=528 R. Molecular weight is 100.2; $\beta=(6.86\times 10^4)/{\rm deg.}$ F.; and $U_*=3.787$ ft./sec.

In Table II on the next page we have tabulated bending and stretching vibrational contributions to the total energy of this molecule. Altogether there are 16 C-H bonds in this molecule. The first horizontal entry in Table II considers the stretching of all C-H bonds, the second and third horizontal entries are for the bending of C-H bonds, the second for H-to-H bending and the third for H-to-C bending. Since

How to Correct for Structure and Molecular Weight



Aliphatic Compounds Use curve A for:

- Hydrocarbons
 Naphthenes
 Esters
- Use curve A' for:

 Acids
 Alcohols

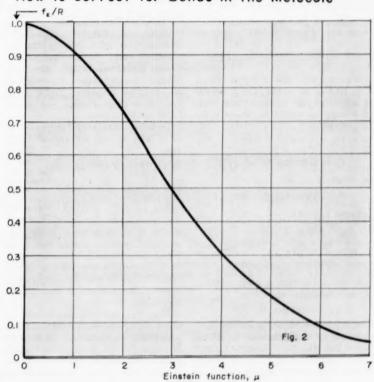
• Ethers

Aromatic Compounds Use curve B for: •Hydrocarbons

- Hydrocarbons
 Halides
- •Esters •Ketones
- Use curve B' for:

 Alcohols
 Amines
 - Amines
 Mercaptans

How to Correct for Bonds in the Molecule



How Stretching and Bending Contribute to the Total Energy of Heptane - Table II

Bond	qiv	q _i B	ω_{ν}	wg	fer	fEB	qf _{Evi}	of ES
≥с-н	16	-	2,960	-	0.0002	-	0.003	_
>c<#	-	8	-	1,450	-	0.0829	-	0.662
₹.c. !</td <td>-</td> <td>8</td> <td>-</td> <td>1,000</td> <td>-</td> <td>0.3610</td> <td>_</td> <td>2 886</td>	-	8	-	1,000	-	0.3610	_	2 886
C-C	6	6	900	370	0.4820	1.5220	2.892	9140
Totals, 2	22	22					2.895	12.688

both types of bending are possible, we assume that half the time of bending is spent in one position, and half in the other.

So for the total of 16 C-H bonds, half are assumed to be bent H to H and half H to C. And in tabulating we have listed eight contributing bonds of each kind. The endmethyl-group bendings of H to H are included with those for the middle methylene H-to-H bendings since the frequencies have the same value.

In Table II, values of ω have been taken from Table I and values of f_{ε} were obtained from Fig. 2 or from Eq. (3).

Now, since n=23, $n_{\ell}'=6$ and the summation of q_{ℓ} equals 22, we arrive at:

$$\frac{3n - 6 - n_{r'} - \sum q_{i}}{\sum q_{i}} = \frac{(3) (23) - 6 - 6 - 22}{22} = 1.59$$

We can take the S factor from Fig. 1. For M=100, the S factor of an aliphatic hydrocarbon such as n-heptane would be about 0.73. Therefore,

$$C_V = (6+6) R + 2.90 + (1.59) (0.73) (12.69)$$

 $C_V = 41.41 \text{ Btu./lb. mole} - ^\circ\text{F}.$

or, since M = 100,

$$C_V = 0.414$$
 Btu./lb. $-$ °F.

From Eq. (4),

$$C_P/C_V = 1 +$$

$$(528) (6.86 \times 10^{-4})^{g} (3.787)^{g}$$

$$25,000 C_P$$

$$C_P/C_V \approx 1 + (0.1426/C_P)$$

After substitution and solution of the quadratic equation,

$$C_P = 0.526 \text{ Btu./lb.} - {}^{\circ}\text{ F.}$$

The experimental value for the heat capacity of n-heptane at 68 F. is also 0.526 Btu./lb.-°F., showing excellent confirmation of the accuracy of the estimating method.

Method la-Sakiadis and Coates

Sakiadis and Coates also proposed a second correlation based on a modified statement of the theory of corresponding states. This correlation is for hydrocarbon liquids only and involves the use of three graphs. It may be applied to hydrocarbons of aliphatic or aromatic types, normal or branched, saturated or olefinic.

Curves of C_r vs. reduced temperature, with further contributions for chain length and branching, are presented in the original paper. For 32 hydrocarbon liquids at a total of 100 temperatures, the average and maximum deviations were $\pm 0.9\%$ and $\pm 2.7\%$, respectively.

Method 2-Chow and Bright

Chow and Bright⁵ related the specific heat of a liquid with its parachor and molar refraction. These latter quantities are very nearly temperature independent and may be calculated for a given substance from atomic and structural contributions.

Defining equations for parachor, [P], and molar refraction $[R_n]$, are:

$$[P] = M \sigma^{0.55}/(\rho_L - \rho_V)$$
 (1)

and

$$[R_D] = -\frac{M}{\rho_L} \left(\frac{(n_D^2 - 1)}{(n_D^2 + 2)} \right)$$
 (2)

where M= molecular weight; ρ_L is liquid density, grams/cc.; ρ_V is vapor density, grams/cc.; $\sigma=$ surface tension, dynes/cm.; n is refractive index; and the subscript D denotes the sodium D line of the spectrum

Eqs. (1) and (2) are known as the Sudgen and the Lorentz-Lorenz equations, respectively. Both [P] and $[R_{\rm D}]$ will be discussed more fully when we reach the surface tension and critical properties sec-

tions of this series of articles, but it will suffice here to observe that each quantity can be calculated by simply adding the various atomic and structural contributions for a given compound.

The contributions to be used are given in Table III, where we have listed the parachor values of Mumford and Phillips. Strain constants for the parachors should not be overlooked. These strain constants are not to be used for molar refraction.

Table III is somewhat more complete than the one used by Chow and Bright (which was taken from Melssner), in that several values not originally listed but available for [P], $[R_D]$ and for [P] strain constants have been inserted.

The equation for estimating C_P at 20 C. is as follows:

$$C_P = \frac{[P] + B}{[R_D] A}$$
 (3)

where C_P is in Btu./lb.-°F.; and A and B are constants for a homologous series.

An arbitrary temperature level of 20 C, was chosen since C_P varies with temperature and [P] and $[R_D]$ are temperature independent; also, most available data are reported at or near 20 C.

Constants A and B, as determined by Chow and Bright for various homologous series, are given in Table IV.

When tested with data for 74 organic liquids of many types, Eq. (3) gives average and maximum deviations of 1.9% and 7.6%, respectively. Although the relation has little theoretical foundation, it is reasonably accurate at 20 C. and is useful for getting a quick estimate of C_P of a liquid in a homologous series when you already know two C_P values for another member of that series. (Knowing two C_P values for any member of a homo-

logous series would then characterize the constants A and B for the whole series.)

For temperature and pressure dependence of liquid specific heats. Chow and Bright used the Watson expansion factor, ω , which we'll treat in detail in the density section of this series.

$$C_P \omega^{3.4} = b \tag{4}$$

where C_p is in Btu./lb.-°F.; and b is a constant for a particular liquid.

Variation of expansion factor, ω, with reduced pressure and reduced temperature is given in Fig. 3. Original report of this work was made by Watson*.

For a reduced temperature equal to or less than 0.65 and for a pressure equal to or less than 10 atm,

$$\omega = 0.1745 - 0.0838 T_x \tag{5}$$

The procedure is as follows: With one known value of C_F at T_1 and P_1 , calculate T_{r_1} . Then obtain a value of ω_1 from Fig. 3 or from Eq. (5), and calculate the constant b from Eq. (4). Then at some other condition of temperature and pressure, a new expansion factor, ω_s , is obtained and used with the previously calculated constant b to calculate the new C_F .

Chow and Bright calculated values of b for 17 organic liquids which ranged from 0.00067 to 0.00194. The constancy of b within a given homologous series is only a rough measure, so that it's best to calculate b for each substance of interest.

For 18 organic liquids at a total of 65 temperatures the average and maximum errors for Eq. (4) were 3.7% and 22.2%. Omitting two liquids (butane under pressure and diethyl ether) lowers the maximum error to 8.2%.

Method 3—Direct Calculation

Heat capacity at constant pressure can be calculated directly from data on density, velocity of sound and isothermal compressibility.

By combining,

$$U_s = (C_P g_o/C_V K_T \rho)^{0.6}$$

and

$$C_P - C_V = T \beta^2 / J K_{TP}$$

we obtain:

$$C_P = \frac{T \, \beta^3 \, U_s^2}{J \, \left(\rho \, U_s^2 \, K_T - g_s\right)} \tag{1}$$

where C_{\circ} is in Btu./lb.-°F.; T is in deg. R.; β is the thermal expansion coefficient, $1/\deg$. R.; $U_{\bullet} =$

Contributions to Molar Refraction and Parachor-Table IIIº

Structure	Molar Refraction	Parachor
C (singly bound)	2 418	9.2
Н	1.100	15.4 5
−CH₂−	4.618	40.0
O (hydroxyl)	1.525	20
O (in ethers, esters)	1 643	20
O (carboxyl)	2 211 4	30 *
f	0.954	25.5
C1	5 947	55
Br	8 845	69
1	13 900	90
N (primary amine)	2 322	17.5
N (secondary amine)	2 502	17.5
N (tertiary amine)	2 840	17.5
N (nitrile)	5.516*	55.5 *
S	9.01	50
P		40.5
Other elements		A
3-member ring.	0	12.5
4-member ring	0	6
5-member ring	0	3
6-member ring	0	0.8
7-member ring	0	-4.0
Double bond.	1.733	19.0
Semipolar-double bond	1.733	0
Triple bond	2.398	38
Singlet Linkage	_	-9.5

Parachor Strain Constants—In the listings below, R is a hydrocarbon radical; X is a negative group; and when the negative group happens to be Br, multiply the strain constant by 1.5.

Use + 3 for carbonyl in the ring.

Use zero for RCH₂X, RCHO, RCOR, RCH₂R, RNH₂, NOR, NOOR and R₃SeO.
Use —3 for RCHX₃, RCOOH, RCOOR, RCOCI,

Use —3 for RCHX₃, RCOOH, RCOOR, RCOCI, R₂CHX, R₂CHR, RCONH₂, ROCOOR, ROCOCI, RSOOR, ROSOOR, R₂NH, NOCI, NO₂R, NO₂OR' N₂O, azides and RSeOOH.

Use — 6 for RCX₃, R₃CX, CICOCI, CISOCI, RSO₂CI, R₂CR, RSO₂R, ROSO₂OR, R₃N, NCI₃, NO₃CI, PX₁, R₃P, PO(OR)₂, BX₃, AsX₂, SbX₃, and CISeOCI.

Use -- 9 for CX₄, R₄C, SCI₄, SO₂CI₂, NOCI₂, POCI₃, SIX₄, SnX₄ and CrO₂CI.

Use — 12 for SOCI₄, NCI, SbCI₅ and PCI₅.
Use — 15 for SCI₆.

Notes—a. Values in this table are taken from R. Herzog, Ind. & Eng. Chem., Vol. 36, p. 998 (1944); H. P. Meissner, Chem. Eng. Progress, Vol. 45, p. 151 (1949); and other sources.

b. Hydrogen on bromine has a parachor of 16.4; on chlorine, 12.8; on oxygen, 10; on nitrogen, 12.5; on sulfur and carbon, 15.4.
c. Includes allowance for double bond.

c. Includes allowance for double bond.
 d. Only for one fluorine atom attached to carbon.
 1.1 for each F in polyfluorides.
 e. Includes allowance for triple bond.

e. Includes allowance for triple bond.

f. As SH, 7.69; as RSR, 7.97; as RCNS, 7.91;

as RSSR, 8.11. g. Value depends on type of compound, apparently differing for various combining

h. As, 54; Sb, 68; Se, 63; B, 21.5; Sl, 31; Be, 42; Al, 55; Cr, 58; Tl, 62; Sn, 64.5; Hg, 69 and Bi, 80.

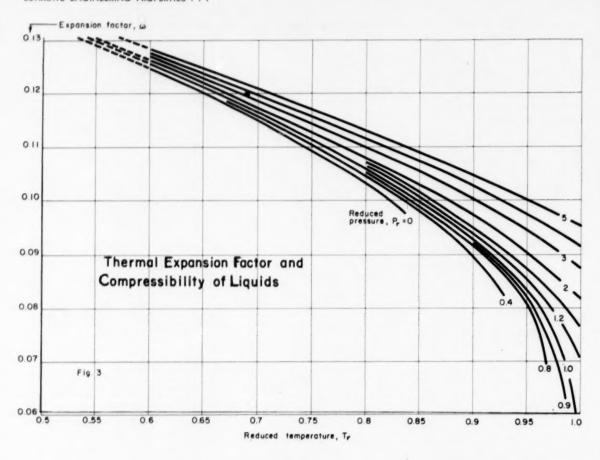
Chow and Bright Constants at 20 C.—Table IV

Homologous Series	A	В
Paraffinic hydrocarbons	18.5	24
Aromatic hydrocarbons*	19.8	8
Acids	19.5	-5.8
Alcohols	15.9	-5.8
Iso-alcohols	21.5	76
Esters	20.25	-5.8
Ketones	15.8	18
Nitriles	16.5	-20
Amines	17.8	45
Monochlorides	17.5	-37
Dichlorides	26	-21
Trichlorides	20	- 89
Chloroacetates	18	58
Dichloroacetates	20.6	-76
Trichlorogcetates	22.6	-94
Benzogtes	15.75	-97
Phenyl ethers	16.75	-41
para-Cresyl ethers	14.6	66

* These are revised values of Ries (Chem. Eng. Progress, Jan. 1954, p. 8A), who noted that some of the specific heats used by Chow and Bright in calculating A and B for aromatic hydrocarbons were not actually at 20 C.

sonic velocity, ft./hr.; J = 778 ft.-lb./Btu.; ρ is density in lb./cu. ft.; $K_r =$ isothermal compressibility, sq. ft./lb.; and g_r is the gravitation constant, 4.16×10^8 ft./hr.*

Calculations made using Eq. (1) must be made carefully as the equation is quite sensitive to values used for β , U, and K_{τ} . The β and U, terms may be estimated closely



from density data, but K_{τ} values must be values that have been verified by experimental determinations.

Tsien' proposed a relation for K_{τ} :

$$K_T \left(\begin{array}{c} R \ T_b \\ V_L \end{array} \right) = \begin{array}{c} 1 \\ 101.6 \ -82.4 \ (T/T_b) \end{array}$$

that is restricted to normal liquids only, and even for these it is a accurate to within only 10%. This is not good enough for use with Eq. (1). Further, K_r increases rather rapidly with temperature (though not with pressure) so that the value used must be at the same temperature for which the other properties are evaluated.

But if accurate experimental values are available, Eq. (1) gives accurate results.

Method 4-Kopp's Rule

Kopp's rule of additivity, discussed previously for solids, has also been applied to liquids." The method is rapid but the accuracy

in a particular instance can be quite low, deviations of 30% being not uncommon.

Further, the rule gives no temperature dependence and can be expected to hold only around room temperature.

Assigned atomic contributions are as follows: carbon, 2.8; hydrogen, 4.3; oxygen, 6.0; sulfur, 7.4; boron, 4.7; silicon, 5.8; fluorine, 7.0; phosphorus, 7.4; and all other elements are assigned a value of 8.0.

So, on a molar basis-and with the exceptions given above— C_{PL} is equal to 8n, where n is the number of atoms in the molecule. Applying Kopp's rule to both solid and liquid gives C_{PL}/C_{PS} the value of 8.0/6.2, or 1.3. This is approximately correct for many substances at their melting points.

Coming—Other Liquids, Gases

Other investigators have proposed some simple empirical relations that can be used to estimate the heat capacities of most liquid materials.

In our next issue we plan to tabulate some representative empirical equations. Then we'll consider estimation methods for the heat capacities of liquid metals, fused salts and thence on to the gas phase.

Later articles will discuss other engineering properties.

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STOP GROPING for those special trick solutions to fluid flow problems.

Basic Equations Are Faster and Accurate

LLOYD M. POLENTZ, Technical Specialist, Robertshaw-Fulton Controls Co., Anahelm, Calif.*

Most chemical engineers are called upon at some time or another to design a flow system, either for gas or for liquid. So, many engineers make it a habit of collecting a multitude of graphs, charts, nomographs and special articles on "simplified" methods of flow analysis in preparation for the big moment.

When the occasion finally arises for actually designing or estimating, the engineer who has made it a practice of relying on such specialized information will paw madly through notebooks, catalogs, reams of notes, tearsheets from magazines, etc. trying to find the quickie method that was tailored to fit just the situation at hand.

Unfortunately, it seems that modifications must invariably be made, corrections applied and curves "bent" just a little to meet the special case under consideration.

True, it's simpler and faster to look up the answer if you happen to have just the right table or graph. And if you're confronted by many problems which

are essentially the same, charts and graphs will save you time.

Simpler, Faster, More Accurate

However, if you are confronted with a variety of problems—which is the usual case—you'll save time and improve your accuracy if you redevelop your ability to handle the fundamental flow equations.

The basic relationship for head loss, or pressure drop, due to fluid friction is some form of the Darcy equation for steady flow in uniform circular pipes running full of liquid under isothermal conditions.

$$F = fL V^2/2 gD$$

where F is the head loss measured in feet of fluid flowing; f is a dimensionless friction factor; L is the length of pipe, ft.; V is the velocity of the fluid flowing; g is the acceleration of gravity; and D is either the diameter of a circular pipe or four times the mean hydraulic radius for a noncircular duct, ft.

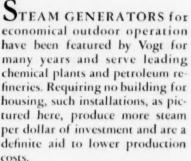
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^{*} Meet your author on p. 314.

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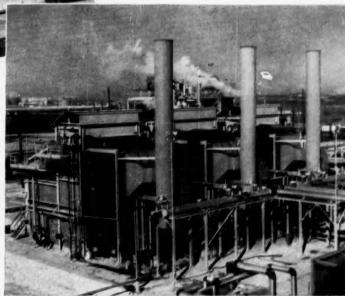
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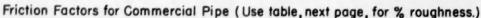


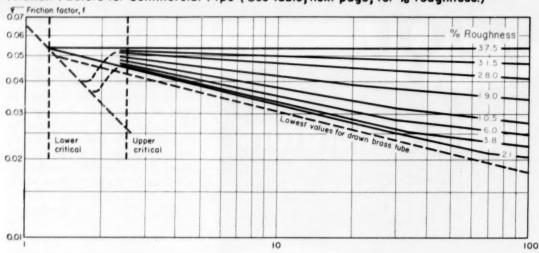


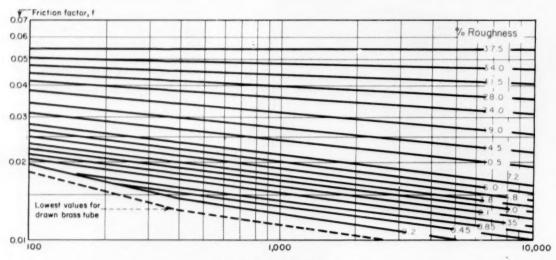
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Reynolds number in thousands

of f are taken from the literature because the same name and symbol are used by some writers to denote various multiples of f. In this article we will use the Pigott and Kemler values for f which correspond to 4f as used in Perry's "Chemical Engineers' Handbook," for example.)

Mean hydraulic radius is the area of the duct divided by the wetted perimeter. In the case of a circular pipe,

$$r_H = 4 \pi r^2 / 2 \pi r = D$$

Shortcuts Lead Back to Darcy

Darcy's formula has long been regarded as the most accurate method for calculating head loss in a pipe or conduit and most graphs and quickie methods are based on it or a modification of the original formula.

There are two principal stumbling blocks in the use of the Darcy equation. First is the evaluation of friction factor, and this difficulty has been obviated by the works of Kemler' and Pigott', and the later work of Pigott' and Moody.' Reliable friction factors can now be found with comparative ease from charts such as the one above and the table on the next page.

Another stumbling block which has troubled many engineers is the use of correct units. Dimensional algebra will surmount this difficulty.

The head loss relationship can be used for both compressible and noncompressible fluid flow. Noncompressible flow is much simpler and covers the great majority of cases that confront the chemical engineer. It is the only case that we'll consider this month. We plan to discuss the compressible case next month.

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This Table Keys Friction Factor Charts on Previous Page

Rough- ness, %	Type A	Type 8	Type C	Pipe, In. Type D	Type E	Type F
0.2	0.35 up	72				
0.45		48 to 66				*******
0.81		14 to 42	30	48 to 96	96	220
1.35		6 to 12	10 to 24	20 to 48	42 to 96	84 to 204
2.1		4 to 5	6 to 8	12 to 16	24 to 36	48 to 72
3.0		2 to 3	3 to 5	5 to 10	10 to 20	20 to 42
3.8		11/2	21/2	3 to 4	6 to 8	16 to 18
4.8	, , , , , , , ,	1 to 11/4	11/2 to 2	2 to 21/2	4 to 5	10 to 14
6.0		34	11/4	11/2	3	8
7.2	*******	1/2	1	11/4	******	5
0.5		3%	34	1		4
4.5		1/4	1/2		*******	3
9.0	******	1/6	******			******
4.0	0.125		3/4			
8.0					*******	
1.5			1/4			
4.0	*******			F+11+X14		
7.5	0.0625	******	1/8	11111111	* * * * * * * *	THE PARKET

Type A—Drawn tubing, brass, tin, lead and glass pipe.

Type B—Clean steel and wrought iron pipe.

Type C-Clean galvanized pipe.

Type D—Best cast iron pipe; cement and light riveted sheet ducts.

Type E—Average cast iron pipe and rough-formed concrete ducts.

Type F—First-class brick, heavy, riveted and spiral-riveted ducts.

Note—In drawn tubing, the actual inside diameter is given. In pipe, the nominal size of standard weight is given.

Air or other gases may be considered to be noncompressible until the pressure drop exceeds a certain amount. But at what pressure drop or velocity of flow will you get an excessive error if you neglect compressibility of the gas?

Shapiro states that "The error produced by neglecting compressibility in the computations of pressure variations is of the order of one-fourth the square of the ratio of the stream velocity to the sound velocity." Velocity of sound in a gas is found from:

$$c = (kgRT)^{1/3}$$

where c = velocity of sound, ft./sec.; k = ratio of specific heats, C_r/C_v , dimensionless; g is acceleration of gravity; T is absolute temperature; and R is the universal gas constant.

For air at 70 F., e=1,130 ft./sec. So for an error of less than 5% due to ignoring compressibility, the velocity of air in a duct should not exceed 505 ft./sec., according to Shapiro's estimate. Since this velocity far exceeds the usual velocities used in chemical engineering applications, it's safe to assume that air is a noncompressible fluid in most cases.

Reynolds Number Fixes Friction Factor

For the accurate determination of friction factor, we depend on the dimensionless Reynolds number.

$$N_{R*} = \rho D V/\mu$$

where ρ is density in slugs/cu. ft.; D is circular diameter or four times the mean hydraulic radius, ft.; V is the average velocity in the pipe, ft./sec.; and μ is absolute viscosity, lb.-sec./sq. ft.

After we evaluate Reynolds number, we can use it to estimate a friction factor. But in arriving at a Reynolds number, viscosity can be a troublesome point. If the viscosity is given in centipoises, divide by 47,800 to get lb.-sec./sq. ft. If the viscosity is given in centistokes, you can use

$$N_{Re} = DV/\nu$$

where ν is the kinematic viscosity in sq. ft./sec. and can be obtained by dividing centistokes by 93,000.

To determine the density or specific weight of the flowing fluid, we can rely on handbook data for liquids and use the ideal gas law, PV = RT, for gases.

Turbulence and Maximum Friction Factor

Two other basic concepts in fluid flow that we ought to reconsider are:

• The difference between turbulent and viscous flow.

 Maximum friction factor that is obtainable under ordinary conditions.

A measure of the degree of turbulence is the Reynolds number. For low values of $N_{\rm Re}$, the flow is viscous and for high values it's turbulent. Kemler' states that: "The various experimenters have found that under ordinary conditions the critical value varies from approximately 2,000 to 3,000." However, this range should not be applied to special conditions, and the lower critical value is usually considered to be 1,200 rather than 2,000.

As a matter of interest, streamline or viscous flow has been obtained at Reynolds numbers above 25,000 by using smooth tubes and taking special pains to prevent any turbulence at the entrance. But the range of 1,200 to 3,000 will suffice for the conditions you will usually encounter.

At N_{Bs} below 1,200, the friction factor is equal to $64/N_{Bs}$. At N_{Bs} above 3,000, values of friction factor can be taken from the charts on the previous page. If the flow is in the viscous range and the pipe or duct is not circular, estimate the friction factor high for safety since the mean hydraulic radius can be used as a criterion only in the turbulent region. For values in the transition zone it's safest to estimate f a little high, also. Most chemical engineering problems will be well within the turbulent range except when handling very viscous fluids.

Kemler has estimated the magnitude of the maximum friction factor that you are likely to encounter. He concludes, "The data on used and artificially roughened pipes show that if the roughness is not large enough to cause contraction and enlargement



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losses, the friction factor never exceeds the value of 0.054."

Some Examples Illustrate the Methods

A few examples will serve to illustrate how these fundamental concepts can be put to work with speed and accuracy.

Problem 1—Calculate the pumping horsepower and the pressure required to pump linseed oil from a tank at a rate of 100 gpm. through standard 1-in. galvanized pipe, 100 ft. long and at normal tem-

Solution-Lineed oil has a specific gravity of 0.934 and a viscosity of 33.1 centipoises at normal temperatures. The I.D. of 1-in. pipe is 1.049 in. With this information we can calculate a Reynolds

= 0.934(62.4 lb./cu. ft.)/(32.2 ft./sec.2)

= 1.81 lb.-sec.2/ft.4

1) = 1.049 in./12 = 0.0874 ft.

= 33.1 centipoises/47,800

= (6.92 × 10⁻⁴) lb.-sec./sq. ft.

Now to get the velocity of the flowing fluid, we convert the flow of 100 gal./min. to 385 cu. in./sec.

Area =
$$0.785 (1.049 \text{ in.})^2 = 0.863 \text{ sq. in.}$$

Therefore,

= (385 cu. in./sec.)/(0.863 sq. in.) (12 in./ft.)

= 37.1 ft./sec.

and

 $N_{Rs} = (1.81) (0.0874) (37.1)/(6.92 \times 10^{-4})$

 $N_{Re} = 8,460$

With this Reynolds number, we can estimate a friction factor from the charts and table above. The roughness is 7.2% and f = 0.039.

Next step is to calculate the head loss due to the flowing fluid.

 $= \int L V^3/2qD$

 $= (0.039) (100 \text{ ft.}) (37.1 \text{ ft.})^2/64.4(0.0874 \text{ ft.})$

F= 958 ft.

Converting to pressure units,

= (958 ft.) (62.4 lb./eu. ft.) (0.934) (1/144)

=558 psi.

Pump output horsepower is equal to ft.-lb./min. divided by 33,000. Therefore,

(100 gpm.) (8.33 lb./gal.) (0.934) (958 ft.) Output hp. = (33,000 ft.-lb./min.)

Output hp. = 22.6

Problem 2-Another interesting case is that of pumping hot water through an annulus to heat an inner pipe. The procedure would be the same as in solving Problem 1, except for the calculation of D in equations for both N_{Rc} and F.

In this case, D is four times the mean hydraulic radius:

$$r_H = \frac{(\pi/4) (D_2^2 - D_1^2)^2}{\pi (D_2 + D_1)}$$

Then.

$$r_{H} = \frac{(0.25) (D_2 - D_1) (D_2 + D_1)}{(D_2 + D_1)}$$

Or, the value of D to use in the Reynolds number

is the inside diameter of the outer pipe minus the outside diameter of the inner pipe. Using this value for D we can proceed as we did in solving Problem 1.

Problem 3-Calculate blower pressure requirement for supplying 10,000 cfm. of carbon dioxide at 130 F. through 75 ft. of 14-by-18 in. ducting into a chamber at 5 psig.

Solution-The absolute temperature is 590 R. and the absolute pressure is 2,830 lb./sq. ft. The gas constant R in appropriate units is 1,545.

Using the ideal gas law, we find that volume is 7.32 cu. ft./lb. of gas, and the gas weighs 0.1365 lb./cu. ft. Then,

 $\rho = (0.1365 \text{ lb./eu. ft.})/(32.2 \text{ ft./sec.}^2)$

 $\rho = 0.00424 \text{ lb.-sec.}^2/\text{ft.}^4$

We take our viscosity from a handbook,

 $\mu = (0.0353 \times 10^{-6}) \text{ lb.-sec./sq. ft.}$

Duct area = (14) (18)/144 = 1.75 sq. ft.

The velocity of the flowing fluid is 95.2 ft./sec. in this duct and this is low enough for us to ignore the effects of compressibility. The value of D to use is four times the mean hydraulic radius, and

 $r_H = 1.75/2[(14/12) + (18/12)]$

 $r_H = 0.0875/[(14/12) + (18/12)] = 0.338 \text{ ft.}$

 $D = 1.31 \, \text{ft.}$

Grinding the numbers in, $N_{\scriptscriptstyle Re}=1.5 imes10^\circ$ and we can pick a friction factor from the chart.

f = 0.0155

Then,

F = 131 ft. or 0.125 psi.

For a blower that was rated by the manufacturer for air flow, this would correspond to 10,000 cfm. of air at 131 ft. of head, and this would be equivalent to about 1.9 in. of water pressure drop. So a blower capable of supplying 10,000 cfm. of air at a 2-in. of water pressure drop could handle the job when the system was new and clean.

When You Can't Ignore Compressibility

Next month we'll review the fundamentals of compressible flow, for those situations when you can't safely ignore the compressibility.

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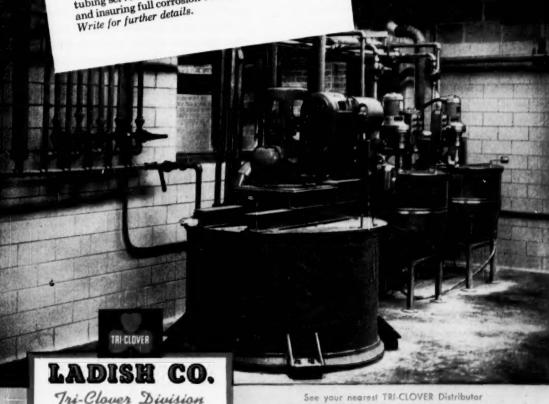


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CHEMICAL ENGINEERING-July 1957

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Can We Afford a \$71.8 Billion Budget?

THE BUDGET submitted to Congress by President Eisenhower for the year beginning July 1 proposes federal spending of \$71.8 billion. In only four years, three during World War II and one during the Korean War, has the government spent more. Under the proposed budget the government expects to collect \$73.6 billion, mostly through individual and corporation income taxes.†

The principal reason for the size of the budget and for this year's increase is an expanding defense program. About 60% of all budget expenditures in the coming fiscal year will be for national security programs. Moreover, this area accounts for about 90% of the proposed increase in federal spending. In addition, as the chart shows, there are large expenditures proposed for purposes other than defense.

Continued budgets of this size, some contend, will lead to inflation and wreck our economy. It has been suggested that they might lead to "a depression that will curl your hair." Yet many insist that the budget, large as it is, still is inadequate in many respects — for defense, schools, agriculture, small business, health, research, indeed, for almost every activity in which the government has become involved.

Is It Really Too Big?

Actually, the proposed budget would place no greater burden on the economy than any budget in the last six years, because our economy has been growing. Federal spending per capita under the proposed

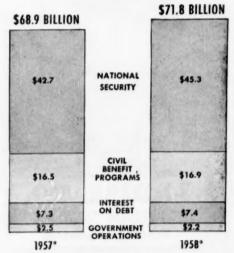
†These figures refer to the regular federal budget and do not include operations of trust funds, primarily for social security programs and the new federal aid program for highways, which are financed by special taxes.

budget will be about \$416, or \$10 more than this year; but our per capita income rose almost \$80 last year. And, because of our increasing population, next year's expenditures will, in fact, amount to less per capita than in 1954 when federal spending was \$4 billion lower.

Another way of measuring the burden of government expenditures on the economy is to compare the purchases of goods and services of all branches of government — federal, state and local — with the total output of the nation. The share of our national product taken by government this year will be about the same as in the past two years and, furthermore, about the same as the average for the past 28 years.

By the standard of any recent year, the budget is within the means of the American economy. In this sense, we can "afford" it. But the pros-

FEDERAL BUDGET EXPENDITURES



•Estimates for flood years ending June 30

pect of steadily increasing budgets, requiring 20% or more of our national income, introduces another threat.

The Real Threat

Large and rising budgets that do not balance government spending with higher tax collections clearly would be inflationary and would destroy the value of the savings and income of all who lagged in the race with climbing prices. But serious dangers will still exist even if our budget continues to be balanced, as this year's is.

- Budgets that require a large take in taxes eat up the savings required to finance private industry. What the taxpayers must give the government they cannot save. This deprives private industry of the savings and resources needed to expand and modernize producing facilities.
- High tax rates also undermine the incentive to save and invest in normal business enterprises by taking such a large share of any income gained. Taxes on corporation income now take 52% of all income over \$25,000. And taxes on individual incomes can take as much as 90% of earnings that remain after this 52% bite.
- High taxes encourage, on the part of both individuals and corporations, the search for "gimmicks" and special treatment. As a leading character in Cameron Hawley's novel Executive Suite observed: "To a far greater degree than most people realize, income tax has become a primary governing factor in corporation management." Indeed, it is only because of the numerous gimmicks and special provisions now available that high tax rates have not already inflicted greater damage to economic incentives.

These dangers comprise the real threat of large and rising federal budgets. It is a threat to continued growth of our economy, and it is no less a threat merely because the budget is technically in balance.

What Should Be Done?

In attempting to hold government spending within reasonable bounds, we should *not* hold back on needed civilian programs. The heavy demands now being urged at all levels of government for roads and schools, for instance, are largely the result of failure to keep pace with the growth of the country. Furthermore, we cannot cut provisions for national security below the minimum level of safety. And unhappily, defense in the rocket and missile age is fantastically and ever increasingly expensive.

What we can do is enforce some financial discipline on our military leaders, and hold down our defense expenditures by making sure their demands are justified and by requiring efficiency. In the civilian programs, though some need to be increased to serve a growing economy, we can eliminate the outright waste.

A More Difficult Job

We must also do something far more difficult, and that is to reduce federal programs of aid to special groups at the expense of all the tax-payers. The new budget calls for over \$5 billion for veterans, and another \$5 billion for farmers. A number of industries and areas stand to receive aid in large amounts based less on necessity than on political pressure. These demands for increased aid, year after year, must be resisted if we are to have any hope of stopping a relentless rise in our budget.

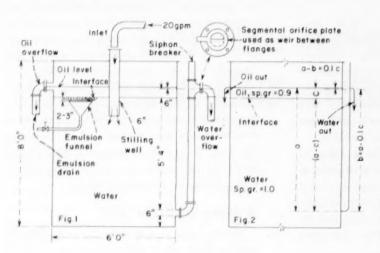
Then, as our national income increases, we can look forward to reducing tax rates and providing greater incentives for the private sector of the economy. Only in this way — by keeping government spending in line with economic growth — can we prevent our federal budget from being a crippling burden.

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Donald CMcGraw
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PLANT NOTEBOOK EDITED BY T. R. OLIVE



Design Accuracy Into Your Decanter

When densities of liquids are close together, interface location is sensitive to discharge levels.

* April Contest Winner by

Chesman A. Lee

Engineer, Evanston, Illinois.

Continuous decanters for the separation of two immiscible liquids of different specific gravities are used in many plants. They are commonly home-made by piping up any suitable tank with an overflow for the light phase and an underflow and inverted discharge loop for the heavy phase. However, when the specific gravities are close together, it is difficult to control the location of the interface between phases unless the difference in levels of the two discharges is accurately calculated and accurately built into the piping.

Calculating the proper level difference is not difficult but it is hard to be certain that it will be attained with discharge piping installed in the usual way. The new idea presented in this article is a simple method of making certain of the two discharge levels by installing segmental orifices to act as weirs in the discharge legs.

For any given ratio of specific

gravities of the two liquids the location of the interface will be determined exactly by the difference in the two discharge levels. If the gravity ratio is near unity, then the interface location will be extremely sensitive to slight changes in the level difference. As the gravity differ-

ence becomes greater, then the sensitivity of interface location becomes less.

Decanters of this type can be used, of course, for any two immiscible liquids of different gravities. However, the design will be discussed in terms of water and oil. Such separators can be used as intermittent separators but are at their best as a step in a continuous process. For instance, a totally inclosed decanter has been used successfully in the continuous separation of water and naphtha.

Fig. 1 shows a design for a particular case but the design is flexible and can be discussed in general terms. An interface is to be maintained at a definite predetermined level. Its best location will depend of course on the relative quantities of the light and heavy phases—that is, on whether we are separating a comparatively small quantity of oil from water, or the reverse. Also, it may be necessary to allow space for emulsions.

Oil and water will separate more readily if they are hot on entering the tank. The design is particularly well adapted for clean liquids. If emulsions are present they will settle out at the interface and will require periodic removal. This is ordinarily done by shutting off the water discharge and floating the emulsion out the oil draw-off,

NEXT MONTH: Non-Clog Filter for Suspended Solids By A. Gruenstein, Winner of the May Contest

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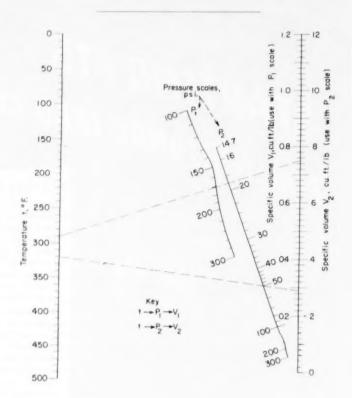
with proper diversion. I do not know that it has ever been done, but believe it would be possible to install a third connection for periodic withdrawal for emulsions. This might be done as at the left in Fig. 1 where a funnel 2 or 3 in. below the interface connects to the outside through a manually controlled valve. The pipe should be large enough to lower the tank level during the emulsion draw-off.

As an example, assume we want to separate 20 gpm. of water-oil mixture containing 1 gpm. of oil of 0.9 sp. gr., allowing 1 hr. retention time for the water. Water entering the tank in 1 hr. will be $19 \times 60 = 1,140$ gal. or 152.3 cu. ft. Using a 6-ft. diam. vertical tank of 28.27 cu. ft./ft. of depth, the water volume will require a depth of 152.3/28.27 = 5.4 ft. This is the depth of the water outlet below the interface. If we use a 4-in. outlet line and a 6-in, sediment space, this will add another 10 in, to the depth for water.

A depth of 6 in. for oil above the interface will be sufficient. This allows 3 hr. settling time for the oil but the real reason for selecting it is that 6 in. is a practical minimum because of the sensitivity of such decanters. Considering the needed depth for water plus oil, it appears that 8 ft. will be a reasonable total tank depth.

We have already noted that the difference in discharge levels is critical. Fig. 2 shows the relations between the various levels. Balancing heads in the tank and in the water-discharge leg, b = (a-c) + 0.9 c, or b = a - 0.1c or a - b = 0.1 c. Thus, for a 6 in, depth of oil the discharge level difference (a - b) will be only 0.6 in. A 0.1-in. error in this small level difference would introduce a 1.0-in. error in the location of the interface and hence in the depth of the oil layer. But if the oil had a specific gravity of 0.7, then a b = 0.3 c, so that the same 0.1-in, error in (a - b) would now produce only a 1-in. error in interface location. In general terms the discharge level difference may be expressed as $(a-b)=(1-\mathrm{sp.\,gr.\,light/sp.}$ gr. heavy) × c. Expressed differently, the depth of the interface below the heavy-phase overflow equals the ratio of specific gravities times the total depth of lighter phase.

Using a segmental orifice plate in both discharge lines to act as an overflow weir enables the levels to be determined accurately. Other points making for good design should also be considered. Use of bulls-eye sight glasses is desirable at the interface. The siphon breaker in the heavy-phase discharge line is an obvious necessity. A stilling well for the feed (in this case a piece of 6-in. pipe extending down through the oil layer) prevents turbulence and permits an open discharge from the skimming pipe, which prevents backsiphonage.



Properties of Superheated 1-Butene

Dale S. Davis
Professor of Engineering, Univ. of Alabama, Tuscaloosa, Ala.

The nomograph above greatly extends the utility of Weber's tables (Weber, J. H., AIChE Jour., 2, No. 2, 210, 1955), which gave specific volumes of superheated 1-butene vapor against temperature for pressures of 14.7, 25, 50, 75, 100, 150, 200 and 300 psi.

The data have been correlated by means of the equation:

$$V = a + b \tanh 0.0005 t$$

where V = specific volume, cu.

ft./lb., t = temperature, °F., and a and b depend on the pressure.

The righthand pressure scale, used with the righthand volume scale, shows that the specific volume of superheated 1-butene at 320 F. and 50 psi. is 2.90 cu. ft./lb.

The lefthand pressure scale, used with the lefthand volume scale, shows that 1 lb. of superheated 1-butene has a volume of 0.750 cu. ft. at 290 F. and 170 psi.



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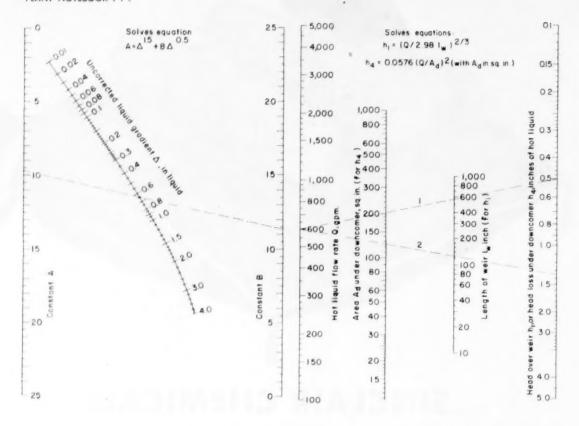
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Charts Aid Bubble Cap Tray Design

Remzi Nokay

Distillation Equipment Designer, Los Angeles, Calif.

Two charts above have been prepared to simplify the calculations for designing bubble cap trays. Fig 1 determines the uncorrected liquid gradient and Fig. 2 the head over the weir and the head loss under the downcomer.

Davies' equation 's for the uncorrected liquid gradient can be condensed as follows:

$$A = \Delta^{1+b} + B \Delta^{0+b} \qquad (1)$$

where A and B have values depending on whether the bubble caps are arranged on triangular or on square pitch. For equilateral triangular pitch:

$$A = -\frac{Q r^{t-3}}{2.15 C_d l_1 (1.5 r - 1.4)}$$
(2)

$$B = \left(\frac{d_a + s(\alpha - 1)}{1.5 r - 1.4}\right) 3r \tag{3}$$

When the number of rows r is known, Eqs. (2) and (3) reduce to:

$$A = MQ/C_d l_1$$
 (4)

$$B = N \left[d_0 + s(\alpha - 1) \right] \tag{5}$$

For caps on square pitch, and for a known number of rows:

$$A = M'Q/C_dl_1 (6)$$

$$B = N' (d_0 + s (\alpha - 1))$$
 (7)

The constants M, N, M' and N' for these equations appear in the accompanying tabulation.

By use of Eqs. (4) and (5) or (6) and (7) to find A and B,

Constants for A and B

Number of Rown, r		ngular itch	Square		
	M	N	M'	N'	
1	4.65	30.00	0.83	6.00	
2	0.82	3.75	0.59	3.00	
3	0.78	2.90	0.62	2.57	
4	0.81	2.61	0.67	2.40	
5	0.85	2.46	0.72	2.31	
6	0.90	2.37	0.77	2.25	
7	0.95	2.31	0.81	2.21	
8	0.99	2.26	0.86	2.18	
59	1.04	2.23	0.90	2.16	
10	1.08	2.21	0.94	2.14	

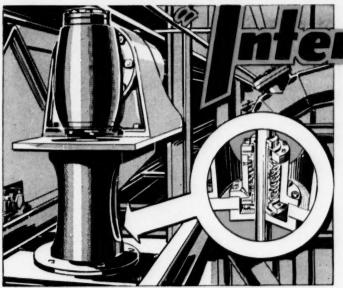
Fig. 1 quickly finds the liquid gradient Δ . However, to correct the gradient and to find C_d , Davies' charts^{1, 2} must be used.

The head over a straight weir h_i , as well as the head loss h_i under the downcomer are ob-

Nomenclature

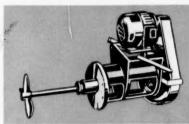
- A Constant of Eq. (1).
- A. Flow area under downcomer, sq. in.
- B Constant of Eq. (1).
- C_4 Constant of Eqs. (4), (6).
- d. Weir height $+ h_1$, in.
- h. Head over weir, in. liquid.
 h. Head loss under downcomer,
- in. liquid.

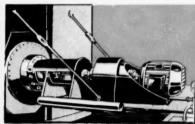
 Total mean free width be-
- tween caps normal to flow, in.
- I Total mean free width between risers normal to flow, in.
- 1. Length of straight weir, in.
- M, N Constants (also M' and N').
- Q Hot liquid flow, gpm.
- Number of rows of caps normal to flow.
- s Cap skirt height, in.
- a 1./1
- △ Liquid gradient, uncorrected, in. liquid.



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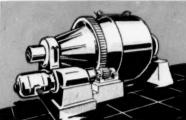
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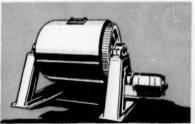
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tained from Fig. 2 which was prepared from the equations:

$$h_i = (Q/2.98 l_w)^{3/3}$$
 (8)

$$h_4 = 0.0576 (Q/A_d)^2$$

where A4, the flow area under the downcomer, is given in square inches.

Example 1-Calculate the uncorrected liquid gradient when the following values are given: r = 7, $l_1 = 34.7$, Q = 500, $C_4 =$ 1.4, $d_s = 4.75$ in., s = 0.375 in. and a = 1.44.

Find M = 0.95 and N = 2.31in the table, for r = 7, and substitute in Eqs. (4) and (5):

$$A = MQ/C_d l_1 \approx 0.95 \times 500)/$$

(1.4 × 34.7) = 9.77

$$B = N [d_0 + s (\alpha - 1)] = 2.31 \times [4.75 + 0.375 (1.44) - 1)] = 11.36$$

Connecting these values of A and B in Fig. 1 gives $\Delta = 0.65$.

Example 2 -An engineer wants to hold the head loss under the downcomer to 0.5 in., hoping to secure an even distribution of liquid, and at the same time having a small enough value that the backup will not be increased appreciably. The fixed values are: Q = 660 gpm., $l_w = 126$ in., height of top of slots above tray = 1.5 in., downcomer seal = 0.5in. Pressure is atmospheric.

He has to calculate the clearance under the downcomer, the value of h_1 , the weir height, and the dynamic seal without liquid gradient.

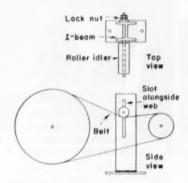
Using Fig. 2, connect $h_4 = 0.5$ in. with Q = 600, reading $A_4 =$

203 sq. in. (Line 1). Then, downcomer clearance = $A_4/l_w =$ 203/126 = 1.61 in. Weir height = 1.61 + 0.5 = 2.11 in. The static seal = weir height minus slot top height = 2.11 - 1.5 =0.61 in. From Fig. 2, $h_1 = 1.37$ (Line 2). Then the dynamic seal = static seal + $h_1 = 0.61 + 1.37$ = 1.98.

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Simple Idler Stops Belt Slippage

Paul N. Cheremisinoff

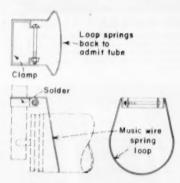
Chemical Engineer, Dumont, N. J.

Unless a flat-belted motor drive is equipped with a pivoted motor base or an automatic idler pulley, more often than not the belt will eventually stretch so as to cause slippage and consequent loss of power. This is particularly true with belt-driven machinery which operates continuously under heavy load. Then, unless one of the commercial devices for taking up belt slack is secured, the drive is likely to continue in use until the slippage causes a serious loss of power, at which time the belt will probably have become useless.

A very simple solution to this problem which I have used successfully in several installations is diagrammed above. This con-

sists of an adjustable roller idler carried in a vertical slot cut alongside of the web in a piece of I-beam, or some other heavy steel stock. This can readily be welded to a base plate and installed alongside of the belt. As the belt becomes progressively

looser, the roller can be lowered by loosening the lock nuts and sliding it lower in the slot. This will take care of the slack in the belt until such time as the opposite sides of the belt actually touch each other. Then, shortening of the belt is necessary.



Safety Loop Prevents Fluorescent Falling

Paul C. Ziemke

Engineer, Oak Ridge, Tenn.

Connections to fluorescent lights are necessarily made by means of two prongs at each end of the tube. These prongs slip into slots in the fixture ends and are then locked by giving the tube a slight twist which locks the prongs between springloaded leaf-like clamps.

Usually this arrangement holds the lamp securely enough

but in time the spring tension may relax a bit or the mounting bolts may work loose in the socket, causing tension failure. Or, the relamp man may fail to turn the pins enough to engage the spring leaves. Any of these causes may allow a tube to drop, not only introducing a hazard, but also making a mess of broken glass and fluorescent powders.

Our shop man came up with a good and simple answer to this problem which has been most successful from every point of view. As the sketch shows, he constructed some light-gage spring steel clamps to which a music wire loop is soldered. In gross lots, these cost us only 30 c. each. The relamp man carries an ample quantity with him and as each fixture is fitted with a new tube he installs a pair of the guards on the sockets. Once in place there is no further work required. To remove a burnedout tube the relamp man merely flexes the spring loop back at one end to allow the tube to be withdrawn. Flexing it a second time installs the new tube.



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23. Distillates

APPLICATION

Pressure drop of a distillate through bubble caps,

$$\begin{split} P &= \left[\begin{array}{c} 0.147 \; \rho_e \; Q^2_e \\ D^4 \end{array} \right] + (S \; \rho_L) \; + \; (2/3 \; L \; \rho_L) \; + \\ \left[\begin{array}{c} K \; \sigma \; (L \; + \; W) \\ LW \end{array} \right] + \left[\begin{array}{c} 0.884 \; \rho_e \\ g \end{array} \right] \left[\begin{array}{c} Q^2 \\ L^2W^2 \; - \; A^2 \end{array} \right] \\ L &= 0.73 \left[\begin{array}{c} \rho_e \; Q^2 \\ W^2 \; g \; \rho_L \end{array} \right]^{\sigma \; 357} \end{split}$$

NOMENCLATURE

- Cross section area of annulus between riser and cap,

Begin and the second of the se

Pressure drop through bubble cap, lb./sq.ft.
 Volume of vapor passing through slot, cfs.
 Volume of vapor passing through cap, cfs.

Depth of seal, ft.
 Slot velocity calculated with the full area of slot

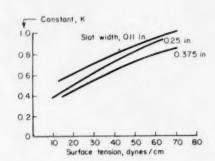
opening, fps. W

- Width of slot, ft

Conversion constant, 32.2 ft./sec.¹
Pressure drop, in. of hot liquid on tray.
Density of liquid on tray, lb./cu.ft.
Density of vapor passing through slot, lb./cu.ft.
Surface tension of liquid, lb. force/ft.

SIMPLIFIED FORMULAS

$$h = 0.29 \left[-\frac{V^{\dagger} \rho_v H_s}{G} \right]$$



1. J. L. Huitt and R. L. Huntington, Pet. Refiner, June

1951, pp. 131–134; Aug. 1951, pp. 111–118; Oct. 1951, pp. 153–154.
 2. C. O. Rhys, Jr. and H. L. Minich, Technical paper presented at the Los Angeles Regional Meeting AIChE, March 1949.

24. Distillates

APPLICATION

Flow of distillates in pipelines.

$$Q = 0.148 D^{2.61} p^{0.54} c/S^{0.54}$$

REFERENCES

G. S. Williams and A. Hazen, "Hydraulic Table," John Wiley & Sons, New York (1920). "The Gas Engineers Handbook," (1934), McGraw-

Hill Book Co., New York.

NOMENCLATURE

= Flow in (42 gal.) bbl./day. = Inside pipe diameter, in.

Pressure drop per mile of line, psi.

= Specific gravity (water = 1.0). = Constant, see note.

Constant c equals 96 for a 43° Be, distillate with an increase of 1% for each 3° Be, decrease. For products lighter than 30° Be, use c equal to 140.

25. Gasoline

APPLICATION

Flow of gasoline through a pipeline.

FORMULA

$$P^{a.54} = Qg^{a.54} (1.25/d^{2.63})$$

NOMENCLATURE

P =Pressure drop per mile of line, psi.

= Flow, bbl./hr. = Pipe diameter, in.

= Specific gravity (water = 1).

REMARKS

12 148 1480 AC 12	
API Pipe Size, In.	Value of $(1.25/d^{2.63})$
1	$1,102.3000 \times 10^{-3}$
11/4	535.7900×10^{-8}
11/2	357.2500×10^{-8}
2	185.1800×10^{-3}
21/2	116.0600×10^{-3}
3	$65.5840 imes 10^{-3}$
4	32.0680×10^{-3}
6	10.9170×10^{-3}
8	5.3033×10^{-3}

REFERENCE

A modification of the Hazen and Williams formula for water taken from the Walworth Co., Inc., literature.



CASH STANDARD Type 44

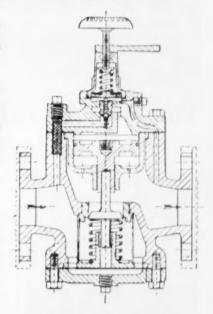
Pressure Reducing and Regulating Valve for Steam Service

Sudden changes in the requirements for hot water in the employees' shower rooms at the Staley plant demand full capacity range operation of the regulating valve with precise control of downstream pressure.

In April of 1956, a CASH STANDARD Type 44 Steam Valve was installed in the line supplying steam to the heater. **Gerald Hammond**, instrument engineer at **Staley**, reports: "The CASH STANDARD Type 44 has given exceptionally good service—the kind of service we expect from all CASH STANDARD products. It has required no maintenance since installation eight months ago."

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Built in Pilot and Main Valve Strainers • Internal Pilot-Operated, Piston-Actuated • Single Seat • Highly Sensitive, Responsive to Smallest Changes in Reduced Pressure • Maximum Inlet Pressure 250 PSI @ 400°F. • Delivery Pressure 5-250 PSI • Available with External Sensing Line • Sizes 2", 21/1", 3", 4".



CASH



For an individual solution to your control problem, contact the CASH STANDARD specialist in your area, or write Dept. A

A. W. Cash Co. and Its Subsidiary, Cash Standard Stacon Corp.
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PRESSURE HYDRAULIC, TEMPERATURE PROCESS AND COMBUSTION CONTROLS





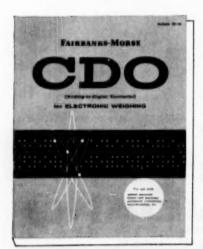








The story of Fairbanks-Morse Electronic Scales in seven volumes



Just off the press—seven new bulletins about Fairbanks-Morse electronic weighing and batching machinery. The covers pretty well identify themselves as illustrated above, except that you might not know that EPC is a completely automatic batching system that operates from punch cards... or that Batchetron is a slightly less automatic batcher with quick provision for manual preset of the cycle... or that CDO is a "read-out" instrument that will translate the weight message of any of the other six into the language "spoken" by automatic typewriters and automatic adding machines and automatic tape punches.

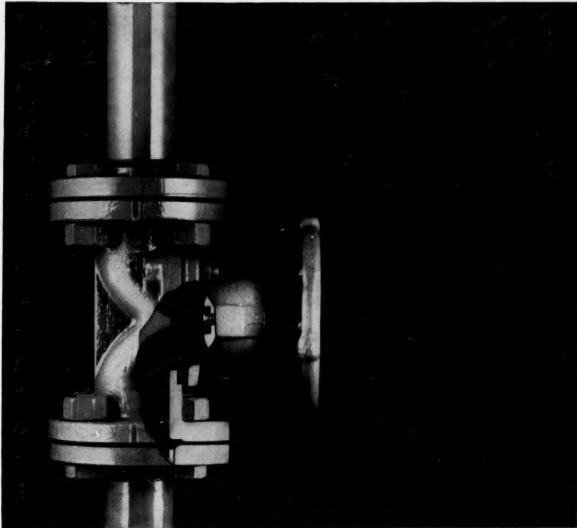
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Corrosion protection is continuous in saran lined pipe-liquid never touches metal.

You can see why Saran lined pipe prevents corrosion

Corrosive liquids never touch the rigid steel pipe . . . it's lined with durable saran

You can stop downtime and other corrosion-caused losses by using saran lined pipe.

The saran liner, over which is swaged a steel pipe, gives complete protection from commonly used acids, alkalies and many other corrosive liquids. At no time do these liquids touch the rigid steel pipe, its fittings or valves.

You'll like the labor-saving way it fabricates. Cutting and threading can be done in the field with conventional hand or power tools. And you can hang it in the same manner as ordinary steel pipe.

Saran lined pipe has high bursting strength, withstanding working pressures up to 300 psi. Fittings and valves are available in cast iron or malleable iron for 150 psi working pressures and in cast steel for 300 psi working pressures.

For tomorrow's protection today, investigate saran lined pipe. The DOW CHEMICAL COMPANY, Midland, Michigan.

SARAN LINED PIPE COMPANY DEPT. SP1593A-1 2415 BURDETTE AVENUE FERNDALE 20, MICHIGAN

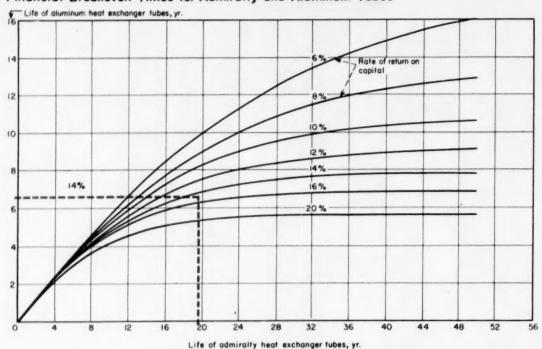
Please send me information on saran lined pipe, fittings	and valves.	
Name	Title	Company
Address	City	State

YOU CAN DEPEND ON



CORROSION FORUM EDITED BY R. B. NORDEN

Financial Breakeven Times for Admiralty and Aluminum Tubes



Capitalized Costs Ease Choice of Materials

Here is how capitalized costs helped decide between admiralty and aluminum heat exchanger tubes. It's a powerful tool for making economic decisions,

Capitalized cost is proving to be a powerful tool in the analysis of economic alternatives.

Just recently a capitalized cost comparison of aluminum and admiralty tubes for a large heat exchanger showed some surprising results.* For equal capitalized cost, aluminum (according to the analysis) could have a service life of 7 yr., but admiralty tubes would have to last 20 yr. This assumes a 14% rate of return on capital (see curves above).

Discussion by Ellis D. Verink, Jr., of Alcoa, at March 1957 American Power Conference in Chicago.

According to Jelen, t capitalized cost is equal to first cost plus the present value of an indefinite number of renewals. It includes the amount which, when compounded at a given rate of interest, will pay for renewing the equipment or process.

$$(K-C) (1+i)^m = K$$
 (1)
 $K=C (1+i)^m/[(1+i)^m-1]$ (2)

Here K is capitalized cost, C is the first cost, m is number of years at interest rate i.

For two alternatives to be

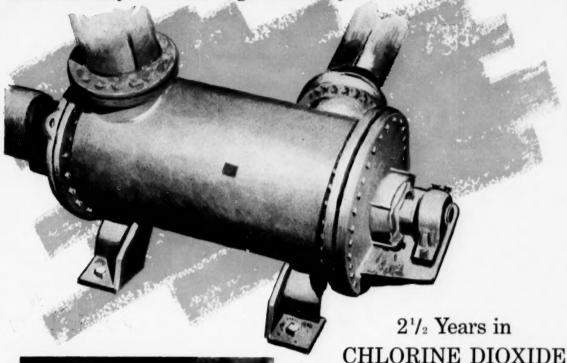
equal financially, capitalized costs must be equal. For aluminum and copper-base alloy heat exchanger tubes the following must be satisfied:

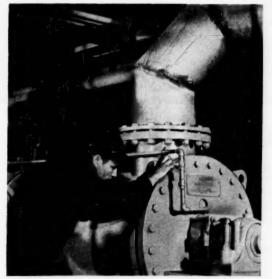
$$K_{Cu} = K_{Al} = C(1+i)^{m(Cu)} / [(1+i)^{m(Cu)} - 1] = C(1+i)^{m(Al)} / [(1+i)^{m(Al)} - 1]$$
(3)

How to Use Capitalized Cost

The table and charts show a composite case, based on actual experience, for a large power plant condenser, where aluminum and admiralty were under consideration for Tubes are 1 in. × 30-ft. Maintenance is equal for both materials of construction.

Initial cost, C, includes labor for installation; allowance for incremental cost of fuel occaHAYNES Alloys solve the tough corrosion problems





... Process Equipment Protected with HASTELLOY Alloy C... can be used to handle acids, fats, oils, or other corrosive materials. This vessel made of HASTELLOY alloy C handles chlorine dioxide used in a pulp bleaching process.

To give greater brightness to kraft paper, the pulp is bleached with chlorine dioxide (ClO₂). This creates a mixer and equipment problem—some of the mixer materials lasted only six months.

... and still operating

One mixer, lined with ½-in. HASTELLOY alloy C sheet, has lasted 2½ years—5 times longer than any previous material used. A mixer made entirely of HASTELLOY alloy C has a full life expectancy of 10

If you have a severe corrosive condition, it will pay you to investigate the use of HASTELLOY alloys. Send for Booklet. Address HAYNES STELLITE COMPANY, Division of Union Carbide Corporation, Kokomo, Indiana.



HAYYUES

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Comparing Capitalized Costs of Heat Exchanger Tubes

	Admiralty	Alc. 3003 Aluminum
Size and gage, in	1 x 0.049	1 x 0.058
Number of tubes	14,000	14,000
Length, ft	30	30
Surface area/linear ft., sq.ft	0.262	0.262
Weight/linear ft., lb	0.568	0.204
Total footage for 110,000 sq.ft., ft	420,000	420,000
Price/Ib. (approx. Dec. 1956)	\$0.662	\$0.95
Total tube cost (approx. Dec. 1956)	\$158,000	\$82,000
Cost of labor, etc. for tube replacement	\$1/tube	\$1/tube
Time to tube each, days	21	21
Incremental power cost/day	\$1,200	\$1,200
Scrap value (approx. Dec. 1956)	\$0.17/lb.	\$0.17/lb.
Value of scrap (half of weight)	\$20,000	\$7,300
Accumulated costs		
Total tube cost (material)	\$158,000	\$82,000
Cost of installing tubes	14,000	14,000
Incremental fuel cost during outage	25,200	25,200
	\$197,200	\$121,200
Less scrap	-20,000	-7,300
Net cost	\$177,200	\$113,900
	-113,900	•
Net saving with aluminum	\$63,300	

sioned by outage and utilization of less efficient units; material costs and scrap value.

Substituting in Eq. (3). it's possible to solve for m_{40} , the number of years of life necessary to give equal capitalized cost for a given life of admiralty.

The curves were developed from this equation, using data in the table. Taking 14% as a typical rate of return on capital, if aluminum tubes last 8 yr., admiralty tubes can never break down. The curves indicate then, that it would be less expensive to replace aluminum tubes every 8 yr. (at 14%) than to put in admiralty, even though admiralty tubes would never need replacement.

Salvage Values

For the sake of simplicity, salvage value has been treated as if it were a credit which appears now. Actually, salvage value (L) is not realized until some time in the future. The equation for salvage value at some future

time gives a negative cost and K will be equal to

$$-L (1+i)^{m}/[(1+i)^{m}-1]$$
 (4)

To get this into value at the present time, multiply by 1/(1+i). Then actual capital cost is the sum of the first cost and salvage value:

$$K = -\frac{C (1+i)^m}{(1+i)^m - 1} - \frac{L}{(1+i)^m - 1}$$
(5)

Here L is the salvage value to be realized at m years. Treating salvage in this manner reduces the breakeven time to 6.3 yr. instead of the approximate 7 yr., compared with 20 yr. for admiralty.

Remember these financial breakeven periods in no way limit the life of equipment or materials of construction. They are very useful for comparing alternatives, but obviously aluminum could last for more than 7 yr., and it would be highly unlikely that admiralty would stand up for 20 yrs. in service.

Titanium Descaling Process Announced

A new descaling process for titanium metal promises to be an important link in the decreasing price trend for titanium equipment.

Developed by Temco Aircraft Corp. in Dallas, Tex., the new process calls for running an electric current through titanium parts (which have an oxide coating developed during heat treatment) while immersed in an acid solution. Fewer parts are now rejected, and the process reduces labor costs compared with older methods.

At least three other methods are in use. In one, scaled titanium is immersed in a nitro-hydrofluoric bath. But grease, oils, inks, and many other materials retard action of the acid. Most oxide coatings are usually uneven, and the acid bath can produce severe etching, unless short immersions are used with hand scrubbing.

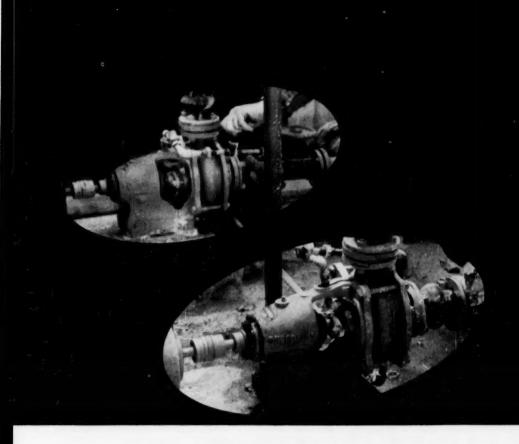
Another technique, molten salt baths, involves temperatures of 800 to 900 F. Close temperature control is essential, since cooling reduces action of the bath and higher temperatures may ignite the metal. Also, metal descaled in molten baths is discolored, and needs some chemical cleaning treatment.

Abrasive scale removal methods frequently used on forgings produce a scratched, discolored metal, not suitable for many applications.

New technique calls for connecting the titanium metal to a cathode lead from a direct current source and immersing in an electrolytic bath of 1% by volume 48-70% HF, 4% by volume 38-46 Be. HNO₅, 20% by volume 60-66 Be. H₂SO₄, 75% by volume water, and 3-5-oz. of ferrous and aluminum sulfates.

Sulfuric acid and sulfates inhibit reaction of the solution on the base metal and prevent formation of a black coating.

Then the technique calls for suspension of a second electrode of titanium or ferrous metal in the electrolyte. Current direction is reversed from one to three minutes, and this cycle repeated until the oxide film is loosened or removed.



NO DURCOPUMP FAILURE

in 24-hour alum service at The CROSSETT Company, Crossett, Ark.



Series H Durcopump. A heavy duty process pump to handle high heads at most capacity ranges at normal or elevated temperatures.

Because Durcopumps have given excellent service under acid conditions in their Kraft Paper Mill, The Crossett Company specified additional Durcopumps for pumping alum solutions in the stock preparation area of their new Bleached Food Board Mill. The pumps illustrated are part of a continuous system preparing dilute rosin, starch, and alum for addition to the stocks. One pump operates twenty-four hours a day, seven days a week. The other pump is a standby, as down time would mean a plant shut-down. To date there has been no down time due to pump failure, and there has been no maintenance beyond routine servicing.

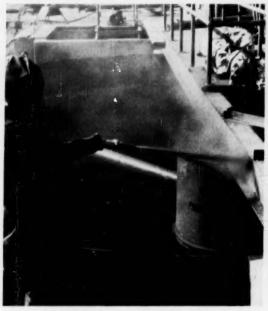
The Crossett Company's new mill produces 150 tons daily of bleached food container and packaging board. The new mill utilizes both pine pulp and pulp from some grades of hardwood timber previously in only limited use. It is the first mill of its kind.

Why not let Durco help solve your corrosion problems, too? For pumps, valves, filters, and other engineered equipment to handle corrosive solutions, call or write.

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SANDBLASTING prepares 25-ft. dia. clarifier for . . . CORROSION RESISTANT epoxy paint coating.



Epoxy Coating Halts Corrosion of Clarifier

Faced with handling a highly corrosive slurry in a clarifier, Trubek Labs reduces costs by using steel, coated with a new, highly resistant epoxy-based paint.

Epoxy coatings have been flirting with the chemical industry for several years now, but high costs and unsuitable techniques prevented epoxys* from making much headway.

This in spite of the coating's resistance to impact, acids, alkalies and solvents.

But now it looks as if the barriers are crumbling. In one of the first large-scale chemical equipment applications, Trubek Laboratories in Rutherford, N. J., is using a 5-mil thick epoxy coating on a 25-ft. dia. steel clarifier.

Involved in the separation of a corrosive sludge, the hard coating is bearing up against combinations of CaSO, Al(OH), MgSO, chromium hydroxides, iron hydroxides, sand, dirt, and residues. Water above the sludge in the clarifier has a pH of about

8 and contains dissolved solvents with a layer of floating insoluble solvents.

Need for Waste Treatment

Until recently, this material was dumped into a shallow creek running into the Hackensack River. In line with federal and state stream pollution abatement programs, Trubek decided to install a waste treatment plant. Heart of this plant is the 25 x 10-ft. steel clarifier.

Waste waters come from four plant areas and collect in an agitated neutralizing tank. Generally they're acidic and require caustic treatment. This is accomplished with a pH controllerrecorder which automatically regulates amount of lime needed to bring the waste stream to a pH of 8.

Waste material then enters the clarifier, coated with a twocomponent epoxy paint.

How to Apply Coating

A 100% solids system is available, but at Trubek coating was made up by mixing equal parts of a pigmented-resin solvent solution (55% solids) and a solution containing the cross-linking catalyst. Catalyst (not a toxic amine) is designed for air drying.

At Trubek the coating was brush applied. But rollers or spray equipment can be used as with ordinary paint. After mixing, the material at Trubek had to be used within two to three days. This "pot" time can be varied of course, depending on the type of resin, and amount and type of catalyst used.

Adequate precautions have to be taken to insure proper ventilation during the painting operation. At Trubek this was no problem, since painting was done outdoors.

First, all surfaces were

Resin formed by the reaction of epichlorohydrin with the condensation product of phenol and acetone.

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performance from



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ELECTRONIC SPECTOGRAPH analyzes the composition of alloys from which condenser and heat exchanger tubes are made. From the very beginning, product performance and customer satisfaction are essential. Maintaining high metallurgical standards means high tube quality—it starts here.



Modern Draw Bench (its size speaks for itself) and others of the same "caliber" bring copper, alloy condenser and heat exchanger tubes down to exact, uniform dimensions.



A HIGH-TEMPERATURE ANNEALING FURNACES give tubes the proper physical characteristics.



4 CLOSE INSPECTION of diameter, wall thickness and surface finish is made—another step that assures you that your Bridgeport tubes are made to flaw-less standards.



Corrosion Research is continuous at Bridgeport Corrosion Laboratories. Here the many alloys used under all corrosive conditions are tested; new alloys are developed from the knowledge and experience acquired here and in the field.



BRIDGEPORT CONDENSER & HEAT EXCHANGER TUBES

Bridgeport Brass Company · Bridgeport 2, Conn. · Offices in Principal Cities

In Canada: Noranda Copper and Brass Limited, Montreal

cleaned using a compressed-air blast with fine grit. Air was kept free of detrimental amounts of water and oil with separators and traps.

All grit and dust was then thoroughly cleaned from the steel surfaces and supports. Then, a brushed undercoat of zinc chromate epoxy primer was applied; followed by three successive layers of light gray epoxy paint.

One day drying was allowed between coats. Final cure, and maximum chemical resistance, results in between four to seven days, depending on temperature. A mil gage checked coating thickness periodically.

To produce the 5-mil finish—which has many of the properties of a baked film—called for 1 gal. of paint (resin and catalyst solutions) per 440 sq. ft. of surface. A gallon* of the epoxy paint (resin and catalyst) costs about \$9.50.

^{*} Protex-A Cote, Inc., Newark, N. J.



Smoke Stack Proves Corrosion Culprit

Within three weeks after a 510-ton absorption refrigeration unit started operation at Schick's Lancaster, Pa., air conditioned plant, serious difficulties developed, which shut down the equipment.

Pipes were corroding, spray nozzles were plugging up and copper condenser tubes failed. Water used in the cooling system was hard and developed scale. But surprisingly, analysis* of the water in the system also revealed very strong corrosive conditions.

Deposits, collected from the condenser attached to the plant cooling tower, contained iron

• Water Service Labs Inc., N.Y.C

and copper. An iron thermocouple-well removed from the system showed the presence of a heavy copper plate—copper dissolved from refrigerant condenser tubes.

The culprit? A large cooling tower was located close to and downwind from a smoke stack. Discharge from the stack entered the tower, causing the water to become corrosive.

Height of the stack was increased by 15 ft.—just enough to discharge above the tower. This has eliminated the primary cause of corrosion. In addition, a proportioning feed was installed for hard water treatment.

New Corrosion Test Loop

To help in development work on peacetime atomic power, Westinghouse has started using experimental corrosion test loops. These loops supply corrosion information for the design of atomic equipment.

Each loop at the Pittsburgh labs consists of a system of stainless steel pipe containing a fluid which is pumped past test specimens. Chemicals, added to the fluid, vary the corrosive effect. Temperature, pressure and velocity can be varied, up to 2,000 psi. and 600 F.

Fluid is circulated by a canned-motor pump, after a degassing and purification step. A small amount continuously bleeds from the loop and circulates through a deionizing loop for removal of corrosives.

A test loop has two identical test sections which hold the specimens to be exposed to the fluid. Each section can handle about 105 specimens at a time. Also, each can be shut down for removal of specimens without stopping tests in the other section.

Cast Irons Resist Shock

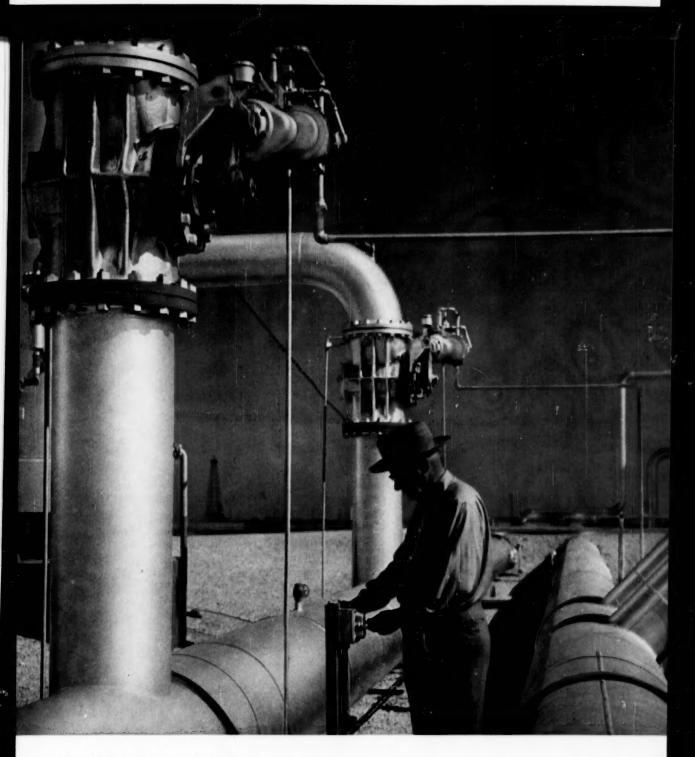
Test results on cast-iron alloys show they are suitable for load carrying applications at temperatures up to 800 F., but not beyond. Creep rupture properties are not good at 1,000 F.

This comes from a recent report made by a joint ASTM-ASME committee on the effect of high temperature on the properties of metals.

Alloying seems to have a marked effect on creep-rupture properties of cast iron. Chromemoly cast iron has the best creep properties of all the alloys tested, but chromium additions alone were not beneficials to creep-rupture.

Laboratory tests carried out show that unalloyed ferritic nodular iron is far superior in thermal shock resistance to any of the gray irons tested. Small additions of Mo and Ni did however improve the thermal-shock resistance of gray iron.

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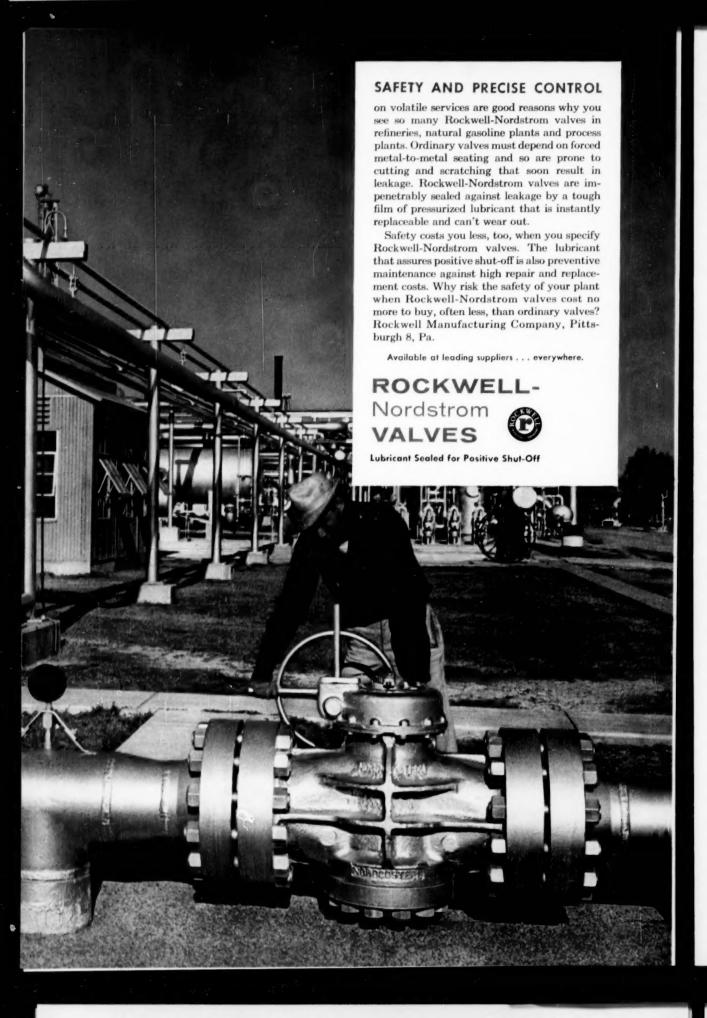
INSTANT, DEPENDABLE RESPONSE to push button or automatic flow control is assured when you specify Rockwell-Nordstrom valves. Their basic advantage for power operation that is lacking in ordinary valves: *lubrication*. Because the plug is seated on a film of pressurized lubricant, a "friction-free" surface keeps the valve ready for instant, smooth operation. And since the lubricant reduces torque and the plug is fully open or closed in a quarter-turn, a simpler, less costly actuator is needed.

Rockwell-Nordstrom valves are available in a complete range of sizes and pressure ratings with electric, pneumatic and cylinder operators. They cost no more to buy—often less—than ordinary valves. Rockwell Manufacturing Company, Pittsburgh 8, Pa.

Available at leading suppliers . . . everywhere.

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Lubricant Sealed For Positive Shut-Off



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July 1957—CHEMICAL ENGINEERING

EDITED BY R. F. FREMED YOU & YOUR JOB



Timely tips on the fine art of changing jobs from a chemical engineer who just has.

Changing Jobs in Today's Turbulent Market

T. K. Kelly, Chemical Engineer, American Machine & Foundry Co., Springdale, Conn.

This article is specifically for technical people—especially chemical engineers—who have the ability to advance rapidly but may lack the decisiveness needed to grasp a golden opportunity.

Sometime in their professional careers, scientifically trained people usually decide that opportunity for advancement lies elsewhere. This doesn't necessarily mean that they actually decide to change jobs. But they do start to look longingly at the greener grass on the other side of the fence.

If nothing else, looking into job opportunities may shower new and more encouraging light on your present position. While looking around may prove that your present salary is below average (for latest salary data, see Chem. Eng., May 1957, p.

313) for your particular professional training and technical skill, it may also show that your employer is not treating you as badly as you think he is.

Roots Are Hard to Pull

When roots are firmly established in a particular local area, when you have established a circle of friends, own—or are mortgaged to—your home and have your children in a good school, it's extremely difficult to uproot the pattern of life that you have taken years to establish.

Unless the future in your new job horizon has very positive advantages for you and for your family, your resistance coefficient to change will be a high positive number.

However, if it is to your advantage to make a change of em-

ployer, then the earlier you recognize the true situation, the less adjustment will be necessary when you relocate.

Scientific Approach Helps

A scientific approach to this matter is surely needed. At best the process of selecting a new employer and of actually making a job change is a difficult and at times a discouraging process. Since the first step in the scientific method is to collect whatever information already exists in the field of study, it is my intention in this article to provide you with some information derived from my recent experiences.

This information may help you simplify the steps in the relocation procedure and, if possible, help you eliminate any that are unnecessary.

Here's What to Expect

Here are some general rulesof-the-road that seem to hold for today's journey into the job market:

- Figure on at least three to six months between the initial inquiry procedure and actual placement.
- Never wait for an answer from one application. Look into as many as there are available.
- On the other hand, never let down in carrying out assignments to the best of your ability for your present employer. You may decide to stay with him.
- Beware of vague advertisements that omit company name and location. Numerous blind advertisements are written as a survey for the availability of persons with specific training in preparation for future or in-

definite expansion of a particular company or in a particular industry. Note also that this preliminary screening will also protect you against applying for a job with your present employer.

 It will help if you maintain a file folder to keep records of correspondence and replies to inquiries.

Prepare a Resume

First step in technical job hunting is to draw up an attractive and concise resume that is sent when answering advertisements. Resumes should be reproducible, i. e. by Ozalid or mimeograph.

You'll want to send a cover letter with each resume. Cover letters are best when written in longhand. Although, some may suggest that a typewritten letter is more businesslike, I have

found that a handwritten cover letter gives a personal touch to your reply.

To return to the resume, divide it into two parts. First give details—on a separate sheet—on things like name, telephone number, address, age, education, degrees, military service, present draft status and number of dependents. Also, your present salary and a list of business references are highly important.

If possible your list of references should include former bosses or persons on a higher supervisory level, who are intimately familiar with your ability to cooperate and operate as a member of a team. Here's how most employers feel about references:

Letters of recommendation carried by job applicants are worthless. What applicant will present a letter to a future employer unless it is filled with glowing terms? Telephone checks of business references have much in their favor. This is the quickest way to get information and you can ask precisely those questions which are appropriate to the job being filled. Answers given over the telephone are often more frank than those committed to writing.

However, some companies refuse to give information about employees because of company policies that prohibit release of any information about present or former employees without first having a signed statement from the employee giving his permission for its release.

In the second part of your resume, cover work experience starting with your most recent position. You should include titles and condensed highlights of accomplishments and degrees of responsibility. One sheet or less is sufficient for each position. Be brief, but don't undersell yourself.

What Happens Next?

Usually, the first response from companies that are interested in you will be an application blank to be filled out and returned, followed by an invitation for a plant visit.

You may or may not be asked to attach a photograph to your application blank. And this is



Decision Game May Cull You for Top Management

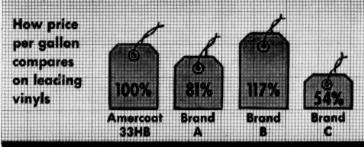
Company presidents shown above are preparing decisions for the IBM 650 that will tell them whether or not they are making correct choices under the pressure of competitive business conditions.

In the game, as developed by the American Management Assn., players face problems exactly like those that top management meets in daily business activities. They are forced to do real strategic planning and every few minutes they must repeat the decision process of selection, analysis and action.

Designed for top executives now, the game has intriguing potential as a testing and selection tool. Although AMA insists that the game is not set up as a test, an obvious area for exploration is the application of some such device for executive testing of technical personnel, including chemical engineers.

YOU CAN'T KNOW

what the real price tag is ...



UNLESS YOU

compare mil sq. ft. per gallon and...

Sq. ft. coverage per gallon, 1 mil thick

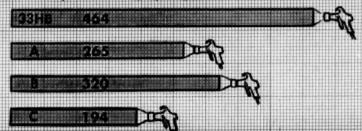


FIGURE THE

material cost of each coating, then get the...

		GALS. COST
	3HB 1411111	2.68 \$17.37
Needed to coat 250	A 19980	4.72 24.78
sq. ft. 5 mils		3.91 29.72
thick		6.44 22.54

REAL COST

by adding labor for the number of coats needed.

Labor & material cost, 250 sq. ft. x 5 mils thick

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Announcing...

A True High Build Vinyl Coating

Amercoat 33HB now gives you even more "mils per gallon" —and at the lowest cost of any leading viny!!

At last, the two major limitations of vinyl protective coatings—critical adhesion and low film thickness—have been largely overcome. Amercoat 86 Primer stopped adhesion troubles, eliminated underfilm corrosion and undercutting, and simplified surface preparation. Now Amercoat 33HB Topcoat builds thick films in fewer coats at surprising savings.

Amercoat 33HB is a "high-build" version of Amercoat 33, the standard of the protective coatings industry for over ten years. 33HB gives you the same high resistance to corrosive chemicals, severe weathering and abrasion, plus 33% greater thickness per coat! The solids content of 33HB tops all other non-mastic vinyl coatings, yet workable viscosity is retained. It applies smoothly and easily by hot or cold spray. No need to stock two types of materials.

New Lower Cost

In evaluating any coating, always look at the cost per square foot, and the number of coats required to build proper film thickness. 33HB is nearly 24% cheaper per mil square foot than traditionally low cost 33... and compared to other leading vinyls, (see chart) savings are even greater. For example, although the gallon price of Coating "C" is 46% lower than 33HB, because of its low solids content the actual material cost for 5 mils thickness is almost 30% higher than 33HB, and the applied cost, (labor and material) is almost 90% higher.

For the full story, send coupon for data on 33HB and detailed cost comparison of the four coatings on the chart.

AMORCO A CORPORATION

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AMERCOAT Cor 4809 Firestone B South Gate, Cal Please send me for Amercoat 33HB	lvd. if.	on .
Name		
Title		
Company		
Address		
City	Zone	_State

where you may run into both a legal and a diplomatic problem. First of all, you certainly are not going to be hired without a personal interview, so the request for a photograph can only be used by the employer as a negative selection device. He can only use the photograph to eliminate those candidates whose appearances don't satisfy him.

The legal problem arises in those states that have fair employment practices laws or state commissions against discrimination. Just to give one example, an employer in New York State is acting illegally if he asks you to submit a photograph as part of an application for employment. If you submit one, you might be aiding him in an illegal act.

My recommendation is that you avoid this problem by not preparing any application photos and by ignoring such a request on any application blank.

How to Be Interviewed

Concerning the job interview, count on spending one full day with each prospective employer. Usual method of travel (reimbursable) is by rail or car. But, air travel is preferable for longer trips so that you only miss one day of work.

Technical candidates have been known to spend a full week hopping from plant to plant by air. In fact, it is a profitable venture.

The interview is a job of selling yourself. Be sure that you have a well-groomed appearance, in spite of the fact that you've been traveling. The secret of the interview is to keep talking about your background and always speak or look directly at whomever is conducting the interview.

The interviewer wants to ask the questions and prefers this to answering your questions. However, obtain details about benefits, vacation, overtime pay, relocation expenses, amount of travel, as well as salary, advancement and company growth potentials. Be prepared in advance with serious answers to this question:

"Why do you want to leave your present employer?"

Answers can include: lack of growth opportunities; interested in relocating in a particular geographical area; higher salary;

A prospective employer likes you to ask this question:

"Where can I expect to be in five years?"

His answer to this question is also a good "in" in finding out details on the possibilities of advancement within the company for someone with your qualifications.

By all means, do not accept an offer of employment without a personal inspection of the company's location and tours of its plants, laboratory layouts, etc. Sometimes one look is worth a thousand letters.

Make a Prompt Decision

A company will expect an answer to their offer—if they make you one—within a week to ten days after your interview.

If you decide to change jobs, be sure to leave your former employer without creating a feeling of animosity. There is a right way and a wrong way to quit a job. Sufficient notice (two weeks is an absolute minimum for technical personnel) of your intention to leave will give him ample time to replace you and give him the advantage of your assistance in training your replacement.

Where to Seek New Jobs

We haven't mentioned much about the first step in changing jobs. Where do you spot a new job opportunity?

In today's turbulent technical market, we would be "writing down to the reader" if we made a list for you. But we do want to be sure that you don't overlook some possibilities that we have found to be helpful. Many companies interview at technical meetings. The ACS employment

clearing house is a superlative opportunity. Unfortunately, AIChE offers no similar service. Your own advertisement in technical magazines brings good response from employers. Sunday editions of large-city newspapers are chock full of display ads for engineers.

Don't forget your own college. The alumni placement bureau is available and in most cases free of charge. And if you work anywhere near a college campus, pay it a visit some day. Maybe one of those company recruiters will settle for you instead of a hardto-get new graduate. In fact, some engineers have been known to get a better paying job with their own employers by meeting the company recruiter outside of working hours and discovering what wonderful opportunities are available within their own companies.

HUMAN WORK

. . . A Rational Activity

Convening in New York last month for their 8th annual meeting, the American Institute of Industrial Engineers (AHE) were challenged by noted management consultant Peter F. Drucker.

To those of you who may have worked alongside of industrial engineers and may have wondered what they were all about, Drucker's challenge may explain the discipline that has now come to be known as industrial engineering.

Your discipline is the discipline of human work, he told them, and human work is a serious, productive and meaningful endeavor. It is a rational activ-

Next Month: What It Costs to Change Your Job

After reading our salary discussion in May, "How Easily Can You Be Replaced?" in the June issue and now these tips on the fine art of changing jobs, you may have been led to an erroneous conclusion. We are not suggesting that you ought to change your job. In fact, next month's You & Your Job feature may convince you that you just can't afford the expense of relocating no matter how luscious a relocation allowance a new employer may dangle in front of you. So, look before you leap. Next month we'll tell the story of a chemical engineer who decided to move and what it cost him.

Announcing Cyanamid CYQUESTERING AGENT

.::handcuffs" for troublesome metal ions

A very small amount of Cyanamid's CYQUEST 40 will "knock down, tie up, and put away for good" those divalent and trivalent metal ions that trigger undesirable reactions and affect the color, clarity, stability or performance of your product. CYQUEST 40 Sequestering Agent is the tetrasodium salt of ethylenediamine tetraacetate, known to its friends as EDTA, and known to its users as the most effective producer of stable metal chelate complexes.

As we have implied, our new CYQUEST 40 is a remarkably effective sequestering agent—and this is true through the widest range of both product formulation and product use. It is a clear, 40% solution of the active ingredient, packed in convenient double-polyethylene-lined fiber drums of 15- and 35-gallon capacity.

Your nearest Cyanamid office will be very happy to cooperate in making our product and services available to you. The more cautious may wish descriptive literature and a sample first...these can be had for the asking.

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PRESSURE & VACUUM CONTROLS H5





UNITED ELECTRIC designed these controls for industrial applications where outside adjustment and calibration are important factors. Types H5 and H12 accurately and sensitively control liquid level alarms and air gas pressures. The type H5 (minimum 2 psi differential) controls up to a maximum of 500 psi, and the type H12 (minimum 3" wc differential) up to 180 psi. Uncalibrated, internally adjusted versions of these controls are available as type J7 and type J6 respectively.

Switch Differential	H5 — Uniform on-off differential, fixed from 2 psi to 30 psi. H12 — Uniform on-off differential, fixed from 3° wc to 2 psi.
Switch Ratings	15 amps. at 115 or 230 volts AC, also 20 amps. or DC switches on specification.
Switch Types	N.O., N.C., or Double Throw, no neutral position.
Size & Weight	H5 — 5½" x 4½" x 1½" weighs approx. 1 lb. H12 — ¾" x 2¾" x 5" weighs approx. 1 lb. 6 oz.
Electrical Connection	Conduit opening in enclosure — 1/4" O.D. Internally-located, terminal block.
Enclosure	Die-cast aluminum case with black wrinkle finish.
Mounting	H5 — Directly, by 1/4" female NPT on bellows housing; or surface mounted by mounting ears on each end of case. H12 — Directly, by 1/4" female NPT on bellows housing.
Bellows	H5 — Spring loaded, seamless brass, stainless steel or monel. H12 — Spring loaded, seamless brass bellows.
Pressure Connections	1/4" female NPT.

UNITED ELECTRIC manufactures a complete line of temperature, pressure, and vacuum controls. UE will gladly modify or custom-build a unit to meet your specifications. Consult a UE application engineer today.



Write for Bulletin No. 5-5 for complete H5 data and Bulletin No. 5-2 for complete H12 data.

United Electric Controls

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YOU & YOUR JOB . . .

ity that is capable of scientific study and analysis. Work is not degrading—as some would have believed when your discipline was founded by Frederick Taylor—it is important because it is productive. And we have no one to ask to study this important function for us.

We know so little about human work. For example, we know nothing about how effective the work of managers and executives is. We don't even know what the work of executives should be.

We don't know enough about the processes of communication, integration, wasted time, inputoutput relationships. Our old tools of analysis break down because today's results are no longer the results of their component parts. There is too much interaction.

This is the challenge that will shape the next 50 years of industrial engineering, Drucker concluded. In mulling over his message, we wondered about the importance of human working relationships in the job of today's chemical engineer. Drucker's challenge applies to our discipline as well.

PROMOTION

. . . Can Kill You

Current belief that promotion can kill you, otherwise known as the boss dies young, is now being discredited. Industrial physicians interviewed in connection with a survey on executive health recently conducted by the American Management Assn. found no evidence that executives are in any worse state of health than other employees.

In fact, one chemical company medical director reported that top executives from his company seem less likely than other employees to suffer from heart disease and high blood pressure.

Details of the AMA study are in the May issue of The Management Review. Another study by Life Extension Examiners answers the question "How healthy or unhealthy are executives as a group?" This study covers 5,000 executives of all ages from 30 companies.

Of the executives examined,

58.9% were considered to be in good shape; 41.1% were reported to be in substandard condition. But Life Extension Examiners concludes that this isn't so bad. "Examine any other representative group of men and you'll find them no healthier than management personnel."

ETHICS

. . . For the Recruiter

Since demand for engineering graduates leads to excesses in college recruiting, the American Society for Engineering Education (ASEE) has decided to issue a code of ethics for recruiting practices and procedures.

In effect, the code says that industry, colleges and students must be prompt, businesslike and honest in their placement activities because of the temptations of today's keen demand for engineering graduates.

Employers should avoid "elaborate entertainment and overselling." There should be no "special payments, bonuses or other inducements," nor should there be reward for a third party who may prevail upon a student to accept a particular offer of employment.

On their side, students "should not hoard or collect job offers." When a student accepts an offer he should let other prospective employers know his decision and he should not accept additional interviews.

Copies of this code of ethics are available at 25¢ each from ASEE headquarters at the Univ. of Illinois, Urbana, Ill.

GRADUATE STUDY

. . . On Company Time

A graduate study center will be established by New York University at Bell Telephone Laboratories, Murray Hill, N. J., sometime this fall. At the center, technical employees will be able to earn advanced engineering degrees by attending classes during regular business hours while receiving full pay.

Cost of instruction will be borne entirely by Bell Laboratories.



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Write for Bulletin A-156

STEBBINS Engineering and Manufacturing Company WATERTOWN, N.Y. PENSACOLA, FLORIDA STEBBINS ENGINEERING ECRE — JOWER BLOG. SCATTLE WASH CANADIAN STEBBINS ENGE & MEG. TOTAL III — NOWING OF MOUNT ROTAL MICHIGANIA SERVICE ASSAULT SINCE 1884 Specialists in Design. Installation and Servicing of Livings and Tile Tanks.

TECHNICAL

Latest Gmelin Volumes

GMELIN'S HANDBOOK OF INORGANIC CHEMISTRY. Issued by the Gmelin Institute. Verlag Chemie, Publishers, Weinheim, Germany. Available from Walter J. Johnson Inc., 125 E. 23rd St. and Stechert-Hafner Inc., 31 E. 10th St., New York 3, N. Y.

Reviewed by M. Wulfing-hoff.

Calcium. (System No. 28, Part A. Section 2, xii and 420 pages. \$55.68.) This volume discusses the element, its occurrence, and its alloys. There are 313 pages on occurrence (cosmic and terrestrial), geochemistry and the significance of calcium in the metabolism of the earth's crust. Geophysical data on 151 pages give deposits of fluorspar, calcium phosphate, Icelandic spar, gypsum and anhydrite.

Calcium-bearing minerals (except silicates) are tabulated on 28 pages. Physical properties of the element are covered on 70 pages; electrochemical ones, on 13 pages; chemical, on 8 pages; physiological hazards, on 3 pages, and alloys with elements of lower system numbers, on 10 pages.

Platinum. (System No. 68, Part D. liv and 638 pages, \$90.00.) The bulk of this volume (589 pages) is based mainly on research work—evaluated very carefully—of the Russian Platinum Institute founded by Chugaev.

It contains new information on the structure of matter based on studies by Chatt and the Russians Chernyaev, Grunberg, Gel'man and others. It covers 2,880 compounds by a system employing a simplified notation of configurations and ligands and abbreviations of referenced Russian literature.

Formula index is arranged by type and number of neutral ligands and simplifies locating the compounds. Cross references

BOOKSHELF

J. B. BACON

to related compounds in different chapters ease orientation.

Introduction (38 pages) explains the arrangement of the material, nomenclature and abbreviation of ligands, and offers a summary of Russian literature.

After a review of the historic development, there follows a description of complex compounds, with emphasis on the significance of the trans-effect. There are chapters on acidity and basicity, oxidation and reduction (including properties of complex compounds of tetravalent platinum, and of individual ligands and ligand groups) and one chapter on the bond of platinum with olefins and other unsaturated compounds.

Finally, there are 4 pages covering metallo-organic compounds, followed by the formula index.

Zinc. (System No. 32, Supplement, xxxvi and 1,025 pages. \$138.00.) The opening chapter on occurrence covers new data on geochemistry, the biochemical cycle based on crystallochemical properties, and distribution as a trace element in soils and organisms. Of the minerals, zinc blende is discussed at greater length because of its importance as a gatherer of trace elements.

The metallurgical aspects take 132 pages covering ore dressing, including flotation methods and equipment. Also discussed is zinc-oxide reduction employing various heating methods (including the New Jersey process) and methods using rotary equipment.

Other topics are electrolytic processes, electrodeposition, amalgamation methods, uses of zinc and its salts and economics. The preparation of zinc oxide, sulfide, lithopone, sulfate and chloride covers 40 pages.

One chapter (124 pages) is devoted to the physics of the hexagonal metal, directional effects upon properties, and monocrystal studies; another 137 pages deal with the electrochemistry, giving potentials for dif-





Famous for many firsts in the industry, Laboratory Furniture's newest improvement for fume hoods, the SAFE 'n EASY way, provides the perfect answer to an old problem. Now, with one simple motion, you can move the baffle by remote control and change the Air Flow inside the operating fume hood . . . without removing the apparatus, and with the sash open or closed. An exclusive STEELAB and WOODLAB feature!



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ferent temperatures and data on primary elements, overvoltages, zinc as cathode and anode in solutions, passivity and glazing. There are 49 pages on electrolytic-process data and properties of deposits obtained.

A 68-page chapter on chemical properties discusses spontaneous combustion and explosivity of zinc dust, reactivity of the metal with oxygen at different temperatures, action of different atmospheres and water, corrosion by inorganic and organic acids, alloys with alkali and alkaline earth metals, surface treatment of the metal, corrosion protection, and application of coatings. There is information on surface cleansing, anodic polishing and etching, chromate and phosphate treatments, primers, and surface coloring, interlayers and plating.

Concluding chapters are on zinc ions, physiological hazards, detection and determination, and 255 pages give data on compounds. Literature references are complete up to the end of 1949.

An Effective Approach

BUILDING AN ENGINEER-ING CAREER. By Clement C. Williams and Erich A. Farber. McGraw - Hill Book Co., New York. 299 pages. \$4.75.

To our society, badly badgered as it is by a confounding array of brainpower shortages, two courses of action, at least, have become imperative. We must get more youngsters into our engineering colleges. And we must keep them there.

"Building an Engineering Career" applies itself to the job of keeping them there. "This book . . ." states its preface, "has been written to enable the engineering student to enter upon his study advantageously and to work efficiently from the beginning." That is the kind of thing that helps keep students in school. And the authors, E. A. Farber of the University of Florida and the late C. C. Williams of Lehigh, do the job with an immensely effective and refreshingly imaginative proach.

A student will succeed in his

engineering studies only if, in the first place, he is intellectually and temperamentally suited to the demanding enterprise. Too often bright and adept youngsters, without the personal qualities required of an engineer, are lured to the profession by a glittering dollar sign or by an ambitious, but misguided parent. We all can recall some such youth from our own campus days.

For example, there was that fellow who always wandered dazedly around the organic lab with some impossible, if intriguing, sludge at the bottom of his test tube and got slaughtered with pathetic consistency on the unit op exams. Yet, over coffee at the local Greasy Spoon, he would bewilder us with marvelous discourses on Baudelaire. And in the end, you'll remember, mortally wounded by entropy, he dropped out of school, retired to Greenwich Village and wrote a racy best seller.

Had he, and his many counterparts, read the first three chapters of Farber and Williams, those wasted years and tuition fees might have been saved. For these pages offer some sound and realistic benchmarks with which a student can honestly evaluate whether or not he is really meant for engineering. In this alone, the book makes a worthy contribution.

However, Farber and Williams go on to counsel students who do belong in the profession. The fourth and fifth chapters usefully outline "How to Study Engineering," with one section happily devoted to "How to Pass Examinations."

But it is the final 12 chapters, in this reviewer's opinion, that gives the book its real strength. In those pages the engineering profession, often no more than a collection of disjointed courses to a student wrapped in day to lay labors, is gathered into clear focus. Seven chapters explore the history of engineering, five recite the outstanding achievements of each discipline and a final chapter outlines the "Social and Economic Effects of Engineering." Together they provide a portrait of a magnificent profession that should provide the kind of inspiration and per-



Aminco forced-convection ovens employ a motor-driven blower which produces movement of a large volume of heated air, horizontally across the work chamber. This, together with the circular arrangement of the heaters, results in uniform distribution throughout the entire work chamber. Air velocity is adjusted by means of a damper. Ovens are equipped with positive locking latches, adjustable perforated shelves, and a removable control panel.

Complete information included in Bulletin 34-37-C





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BOOKSHELF . . .

spective that urges young people to intelligent hard work and success.

The book is intended, and admirably suited, for engineering orientation courses. To us, already in the profession, it has this value: We should make it our next gift to sons and daughters just embarking on an engineering career. It will help make better engineers of them for a society crying for engineers.—

TPF

BRIEFLY NOTED

AICHE STANDARD TESTING PROCEDURE FOR ABSORBERS. 16 pp. AICHE STANDARD TESTING PROCEDURES FOR HEAT EXCHANGERS (Section 2: Condensers). 16 pp. American Institute of Chemical Engineers, 25 W. 45 St., New York 36, N. Y. \$1 each. Provide standard procedures for conducting and interpreting performance tests on equipment.

AIR AND WATER POLLUTION; THE POSITION IN EUROPE AND IN THE UNITED STATES. 218 pp. Publications Office, Organization for European Economic Cooperation, 2000 P St., N. W., Washington 6, D. C. \$3. Summarizes regulations and legislation, general practice and research work in the fields of air and water pollution in Europe and the United States.

ATOMIC ENERGY APPLICATIONS WITH REFERENCE TO UNDERDEVELOPED COUNTRIES. 129 pp. By B. C. Netschert and S. H. Schurr. Johns Hopkins Press. Baltimore, Md. \$2. Surveys applications of atomic energy, present status and future prospects for applications; indicates current and planned activities in international cooperation in atomic energy.

Consulting Services, 1957. 136 pp. Association of Consulting Chemists and Chemical Engineers, Inc., Rm. 82, 50 E. 41 St., New York 17, N. Y. (Letterhead requests with remittance.) \$1. Classifier section classifies members according to over 200 items of activity. Contains index of members by geographical location, including branch offices inside and outside U. S.

DIRECTOR OF GERMAN MACHINERY MANUFACTURERS (1957), 800 pp. Available from Nordeman Publishing Co., Inc., 14 E. 62 St., New York 21, N. Y. \$3.50. Lists 20,000 German manufacturers of machinery, precision instruments and industrial equipment, classified in 9,000 product categories.

FLEXIBLE POLYETHYLENE PLASTIC PIPE (CS 197-57). Superintendent of Documents, U. S. Government Printing Office, Washingington 5, D. C. 10c. Revised and industry-approved commercial standards for flexible polyethylene pipe.

Scientific French. 112 pp. By William N. Locke. \$2.25. Scientific German. 164 pp. By George E. Condoyannis. \$2.50. John Wiley & Sons, Inc. Designed to give the engineer and scientist a reading knowledge of technical articles in French or German.

MORE NEW BOOKS

MAINTENANCE ENGINEERING HAND-BOOK. Edited by L. C. Morrow. McGraw-Hill \$20.

GUIDE TO THE LITERATURE OF CHEMISTRY. 2nd ed. By E. J. Crane, A. M. Patterson and E. B. Marr. Wiley. \$9.50.

GAS CHROMATOGRAPHY. By A. I. M. Keulemans. Edited by C. G. Verver. Reinhold. \$7.50.

STATISTICAL METHODS IN RESEARCH AND PRODUCTION (WITH SPECIAL REFERENCE TO THE CHEMICAL INDUSTRY). 3rd ed. Edited by Owen L. Davies. Oliver and Boyd. 45s.

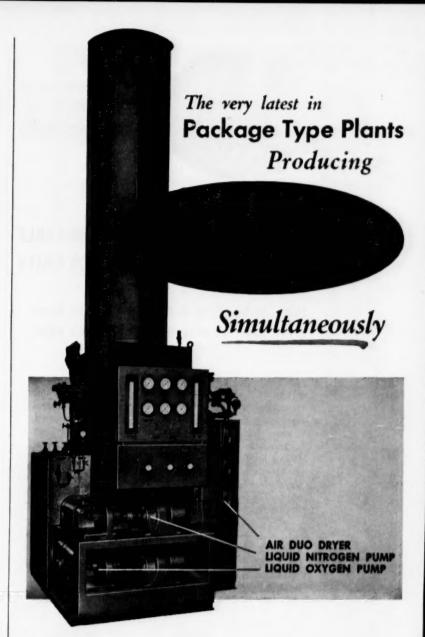
Modern Chemistry for the Engineer and Scientist. Edited by G. R. Robertson. McGraw-Hill. \$9.50.

TECHNIQUE OF ORGANIC CHEMISTRY. VOL. 3. PART II, LABORATORY ENGINEERING. Edited by A. Weissburger. Interscience. \$8.

INVENTORS AND INVENTIONS. By Clarence D. Tuska. McGraw-Hill. \$5.75.

STERILIZATION IN FOOD TECH-NOLOGY. By C. Olin Ball and F. C. W. Olson. McGraw-Hill.

SEMICONDUCTOR ABSTRACTS. Vol. 3. Edited by E. Paskell. Wiley.



With the introduction of our latest, improved design Package Type Generating Plants, production of high purity Oxygen and Nitrogen simultaneously increases production 60% over the production of Oxygen alone, plus a corresponding reduction in the cost of manufacture. Due to its compact design, a minimum of floor space is required and streamlined panel assembly insures instant visibility of all control gauges. Stock sizes from 1500 to 10,000 cu. ft. per hour. Larger and smaller sizes available. 99.99% Argon available on large size plants.

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Now, you can get DURABLA Reducing Couplings to match DURABLA Basic Check Units. Supplied in line sizes from %" to 2", they are recommended wherever a complete stainless steel (18-8) line check valve is required.

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Lloyd M. Polentz

BASIC EQUATIONS ARE FASTER AND ACCURATE. P. 270

This month's CE Refresher author is a technical specialist for Robertshaw-Fulton Controls and, apparently, a devoted Californian.

Lloyd Polentz has spent a good part of the last thirteen years traveling, but only in the process of shuttling back and forth, between the Los Angeles and San Francisco areas, to work or study.

Started his first engineering job in 1943 and completed requirements for a B. S. degree by attending night classes at the University of California. After earning his degree in 1945, he worked on hydraulic oil well equipment for Kobe, Inc.

For the next three years, Polentz taught in UCLA's engineering department, in Los Angeles, while he did graduate work.

Then, he and his wife moved to the San Francisco Bay area "in the hope of escaping the crowds which were converging on Southern California." He became a senior engineer for the mechanical department at UC, in Berkeley. Later, he worked for Pabco as a process engineer (on fluid flow and radiant heat transfer). Then came a similar assignment for UC's radiation lab in Livermore.

"Then back to the crowds and smog of Southern California, which is the hub of engineering activity on the West Coast, to work on warheads for a year."

AUTHORS

M. A. GIBBONS

For the last few years, Polentz has worked in Robertshaw's research department on fluid mechanics and hydraulics.

The Polentz's have three children. Principal hobbies, for our author, are keeping the youngsters entertained and what he terms "backyard mechanics" (making toys and helping Santa Claus).



Liang-tseng Fan

CALCULATE FLUIDIZED HEAT TRANSFER BY NOMOGRAPH. P. 254

Like Co-Author Wen, Liangtseng Fan is a native of Taiwan (Formosa). He also did undergraduate work at National Taiwan University. Graduate work was done at Kansas State College, the University of Michigan and, currently, he's a candidate for a Ph.D. at West Virginia University.

Just now, he's also engaged in the design of radiochemical laboratory and chemical process equipment, including a fluidized reactor, heat exchanger and absorption unit at the U. S. Bureau of Mines Experimental Station, Morgantown, W. Va.

Other industrial experience involves a year of production work at a synthetic organic plant. Research interests include the application of radio-isotopes in the chemical industries and various phases of heat transfer.

Fan is a member of Sigma Chi, Phi Lambda Upsilon, Phi Kappa Phi as well as several technical societies.





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Chicago & Eastern Illinois Railroad

AUTHORS . . .



Max Leva

FLOW THROUGH PACKINGS AND BEDS. P. 258

Author Max Leva is a consulting chemical engineer in Pittsburgh, Pa. His work in the field of fluidization is extensive not only in research activity (he operates an engineering research laboratory) but as a part of his consulting practice, too.

consulting practice, too.

At this writing, Leva is in Europe attending a symposium in London. Afterward, he'll visit a number of chemical plants and universities throughout France, Germany and Holland.

For further background information on Leva, consult our first writeup in the January 1957 issue, p. 294.



Chin-yung Wen

CALCULATE FLUIDIZED HEAT TRANSFER BY NOMOGRAPH. P. 254

Up to his elbows in teaching as well as research, Chin-yung Wen is currently assistant professor at West Virginia University.

Besides handling classes in mass transfer, heat transfer and

"The amount of detail work that went into the preparation

of these reports is truly amaz-

ing. In all the years in which we have been engaged in plant

location work we have never

seen so much data collected on

a particular area."-from a

letter describing previous eco-

nomic studies by Chicago &

Eastern Illinois Railroad.

unit operations, Wen has been conducting research in gas absorption, fluidization and solidsgas transport.

Wen earned a B. S. degree from National Taiwan University, Taiwan (Formosa). Later, he received an M. S. in chemical engineering as well as his doctorate from West Virginia University. He also spent a summer working for the research department of Goodyear Tire & Rubber Co.

He belongs to several technical societies and is a member of Sigma Chi and Phi Lambda Upsilon.



Francis R. Bruce

LOOK FOR NUCLEAR FUEL REPROCESSING BY '65. P. 202

Oak Ridge National Lab's Francis Bruce is associate director of the chemical technology division.

Bruce joined the lab in 1943 and worked for three years in analytical development. Then, he got into solvent extraction in charge of a development group responsible for a U-235 separation process (now being used at the Idaho Chemical Processing plant in Idaho Falls).

Most recently, Bruce has been active in the development of the Redox and Purex processes and concerned with chemical processing for aqueous homogeneous reactors.

Earlier in his career, Bruce worked in research and development at DuPont's Remington Arms division. He received a B. S. in chemistry from Tufts College in 1942.

Bruce is co-editor of Process

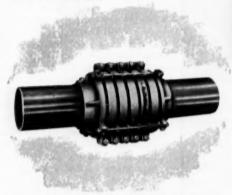


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AUTHORS . . .

Chemistry, a volume of the Progress in Nuclear Energy Series, published by the McGraw-Hill Book Co.

Bruce has three children to keep him busy at home. And, when they don't, he keeps up on his woodworking, photography and trout fishing.



Maxey Brooke

CE FLOW FILE. P. 288

Maxey Brooke is with Phillips Petroleum Co., in Texas. His work is principally administrative although he's classified as a supervisory chemist.

After graduating from the University of Oklahoma with a degree in chemical engineering in 1935, he spent the depression years in a motley collection of jobs—truck driver, pipeliner, seismographic crew member and in construction work. In 1940, Brooke joined a sulfur company on the Gulf Coast as a chemist.

His first assignment in the chemical field was followed by a term with the U. S. Army Chemical Corps: a two-year stint, part of which he spent as an observer at the Bikini atom bomb tests. It was at this time—during spare moments at Bikini—that he initiated the collection of fluid flow formulas which resulted in the present series.

At the end of his military assignment, Brooke accepted a position as water and corrosion engineer with Phillips Petroleum Co. and has continued with them for the past ten years.

He is married and has two children. An interesting sidelight is his hobby: He writes technical books and dective sto-



Ralph A. Troupe

BYPASS ORIFICE EXTENDS RANGE OF ROTOMETER. P. 240

Northeastern University's Ralph A. Troupe has spent the better part of his career in the classroom.

Since 1954. Troupe has held a position as research professor of chemical engineering at Northeastern. Before that time, he spent about four years with Goodyear Synthetic Rubber Co. -first as assistant and finally as technical superintendent. Earlier in his career, he taught at Virginia Polytechnic Institute, the University of Texas and at the University of Louisville. He also worked three years as production supervisor and production engineer for General Tire & Rubber's synthetic rubber division.

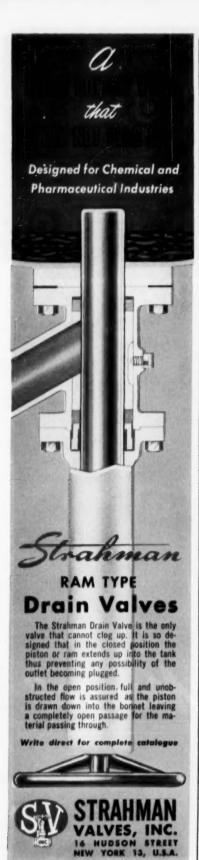
Consulting activities include work on natural gas transmission lines in Louisville and an assignment for the Institute of Industrial Research on an Office of Naval Research project.

Troupe studied at Drexel Institute of Technology for his undergraduate degree in chemical engineering; at Virginia Poly for his master's. Later, he earned a Ph. D. at the University of Texas and did graduate work in metallurgy at MIT.

Professional associations include the American Institute of Chemical Engineers, the American Chemical Society, the National Association of Corrosion Engineers, Sigma Chi, Phi Lambda Upsilon, Omega Chi Epsilon and Tau Beta Pi.

In December of 1956, Troupe served on the planning committee for the American Institute of Chemical Engineers' national meeting. At one time, he was also named treasurer of the





AUTHORS . . .

Boston section.

Troupe has published extensively in his field. Readers of Chemical Engineering will recall, in particular, his article, "How to Tailor Exchanger Area to Fit Batch Cooling Time (Sept. 1952, page 128).

Just now, Troupe makes his home in Wakefield, Mass.



William Clark

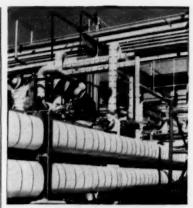
ACCURATE WAY TO ESTI-MATE PIPE COSTS. P. 243

Cost Expert Clark was born 36 years ago in New Jersey. He went to high school, there, in Paterson, but acquired all of his engineering education through the USAFI, the ICS and the University of California Extension Service

Before joining Dow Chemical Co.'s Western Division, in 1946, he worked for Wright Aeronautical Corp. and served three years in the U.S. Army.

Clark is a founding member of the American Ass'n of Cost Engineers and was active in organizing a San Francisco Bay Area chapter of the society. With Dow Chemical, he has been specifically responsible for cost estimating and for collecting cost data for the past six years. Our readers will recall his previous articles on rubber lining costs (Chemical Engineering, March 1955) and pump installation costs (Chemical Engineering, August 1955).

Author Clark wishes to acknowledge the assistance pro-vided by Dow's Midland and Texas Divisions' estimating departments in the preparation of the current article.



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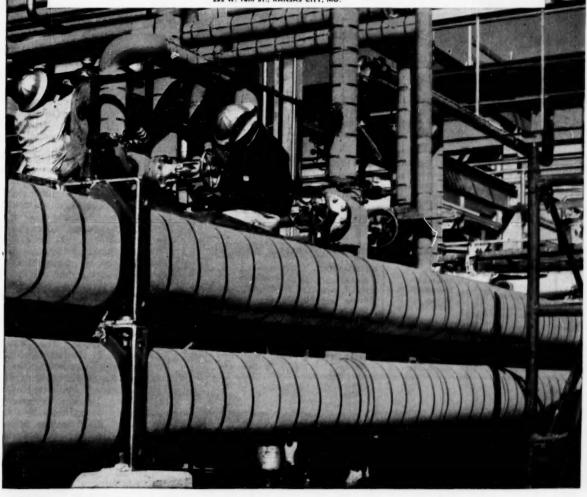
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ACE

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LETTERS:

Pro: High Temperatures

Sir:

It has been a long time since I have read so outstanding an article on an important scientific frontier as the Stanford Research Institute paper on High Temperature Technology which appeared in your March issue (pp. 237-252). Authors and editors certainly deserve great commendation for presenting so worthwhile and clear a picture of this subject.

It succeeded in rationalizing quite a few things for me, and I'm sure it will long be a standard reference paper.

R. E. BIRCH Harbison-Walker Refractories Co. Pittsburgh, Pa.

Don't Misapply Pump Seals

Sir:

Mr. Tracy's feature report on pump seals in your April issue (pp. 239-254) is certainly one which every process engineer should study and understand thoroughly. The presentation summarizes in a very comprehensive manner the many different ways to seal the shaft leakage on centrifugal pumping equipment. The large number of illustrations and the magnifications of the seal face areas is certainly an excellent way to present this material.

The multiplicity of choices in relation to the use of mechanical seals and packing demonstrates very clearly how easy it is to misapply both seals and packing. There is a great tendency to condemn all seals because of the misapplication of a single type, or to try to apply a given seal arrangement in a universal manner because good experience was obtained on a single application. There appears to be little doubt that if more thought was given by application engineers to the problem of shaft sealing prior to purchasing the equipment, many thousands of dollars of maintenance would be saved.

Pump manufacturers are very

PRO & CON

willing to recommend the type of seal and cooling arrangement required for a specific pump when used for a specific application. However, they need complete details concerning the application to make the best recommendation. Mr. Tracy's article helps demonstrate the type of data required by the manufacturer.

DAN R. RANKIN

Peerless Pump Div.

Food Machinery & Chemical

Corp.

Los Angeles, Calif.

Five Bouquets, One Brickbat

Sir:

Yesterday on an airplane trip I managed to read the April issue of Chemical Engineering. This indeed was an accomplishment for me; of late, due to a change in job status, I have been just too busy to read-ever. sometimes to sleep.

This issue was magnificent. Article after article was of key

interest to me.

· For many years I have been interested in steam-jet air ejectors. Berkeley has given you a magnificent presentation. I suggest that you do your utmost to have him write for you again.

· Veith's article on nondestructive testing techniques was

most interesting.

· Gambill's paper on gas conductivity was right up my alley.

· The feature report on pump seals at one time would have been of great interest to me. I believe you did the right thing in devoting so much space to this specialized field even though some of your readers may not have a use for it.

· The section on Meet Your Authors is of great interest to You might consider reprinting this material in a bound volume to be used for sales promotion work in your advertising and circulation departments.

But just to show you that it is impossible to please everybody: I purchased the book, NO SHAPE TOO SCREWY

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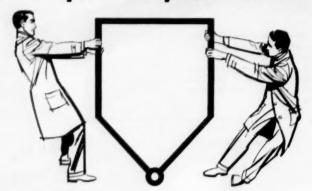
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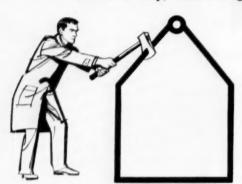
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PRO & CON . . .

"Developing Your Executive Skills," as referred to on p. 339 of the April issue. I found the presentation in this text to be quite uninspiring.

If you wish to publish any of this letter you may do so, but please withhold my name.

NAME WITHHELD

Chemical Engineer Downingtown, Pa.

► We're glad to learn that at least one of our subscribers can sneak our magazine on board an airplane without having to pay for excess baggage.—ED.

More Work at Less Cost

Sir:

I would like to make this one comment on your article in March (pp. 156-158) entitled "Double-Fired Heater Needs Less Tube Area": The direct-fired heater design is a step in the right direction toward the objective of making the furnace do more work at less cost.

CHARLES BLISS Foster Wheeler Corp. New York, N. Y.

Pro: CE Flow File

Sir

Your CE Flow File by Maxey Brooke may not be your very best feature of the year, but 1 suspect it is about the most popular. I am clipping each sheet for my ready reference file, and I'm sure many others are doing the same.

In Formula No. 8 (Mar. 1957, p. 294), what unit does H represent? And in No. 9, there must be some expression of slope, or else flow would be zero. Perhaps the formula represents dimensions measured at the end of a pipe with free-flowing discharge.

KENNETH M. HOLADAY Anheuser-Busch, Inc. St. Louis, Mo.

Sir:

In Formula No. 8, H is the pressure at the gage in ft. of water.

In No. 9, the pipe should be substantially horizontal. I have used it with slopes up to 5% without serious error. Of course, in a horizontal pipe, there would have to be a hydraulic gradient,

or there would be no flow. I have used it both as a free-flowing discharge and non-free-flowing discharge.

I apologize for these errors of omission.

MAXEY BROOKE

Phillips Petroleum Co. Sweeny, Tex.

Independent Inventions

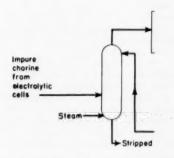
Sir:

When you published my Plant Notebook article, "Ratio Feeder Gives Constant Delivery" (Feb. 1957, pp. 282-4), I thought the idea was novel—at least so far as the published literature was concerned.

However, I have received a communication from M. Bauwens, engineer at Etablissements Kuhlmann, Paris, France, showing that he published an article in April 1956 in L'Industrie Chimique which embodies the essential method of my ratio feeder.

Apparently M. Bauwens and I came up with the same idea, since we have both used this method for several years independently.

GERALD A. LESSELLS Olin Mathieson Chemical Corp. Brandenburg, Ky.



We Caught This in Time

INTER-OFFICE MEMORANDUM
To: Henry Groll, Illustration
Dept.

From: Margaret Wenk, CE Art Editor

Looks like your draftsman has had experience outside the chemical process industries. The word is "chlorine."

► See pp. 154-156 of our June issue for the straight story on chlorine recovery processes by Diamond and Hooker.—Ed.





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NAMES IN



Robert W. Lundeen

Man of the Month

AIChE points to versatile man at Dow as 1957's outstanding young chemical engineer in the San Francisco Bay area.

"I'm the world's worst specialist."

That's how Bob Lundeen describes his lack of specific interest in any particular unit operation or unit process.

Maybe so. But if so, it appears that Northern California's chemical engineers prefer versatility to specialization. For, Lundeen was recently named this year's outstanding young chemical engineer by his colleagues in AIChE's Northern California section.

In common with the two previous awardees, Stanford Research Institute's Nevin Hiester (Chemical Engineering, April 1955) and Shell Development's Charlie Nelson (Chemical Engineering, June 1956), 36-year-old Bob Lundeen has already accumulated broad experience in chemical engineering research, development, design and management. Of note: none of the three outstanding young chemical engineers has had much experience in production.

THE NEWS

M. A. GIBBONS

► The Beginnings-For his education as well as his bride, Lundeen stuck pretty close to his native Astoria, Ore. He earned a B.S. in chemical engineering, in 1942, from Oregon State College. Almost immediately, he entered the Army Air Corps as an aviation cadet and married an OSC co-ed from Portland, Ore. The Air Corps sent him to the University of Chicago's Institute of Meteorology for a year's graduate study. In March 1946, he was discharged as a major.

While still on terminal leave from the Army, Lundeen joined Dow's Western Division in Pittsburg, Calif., as a research and development engineer. First assignment was to work with a group on the development of a new xanthate process. Later, Lundeen conducted hydrocarbon chlorination process evaluation and feasibility studies for the process and did the chemical engineering design for a new polymerization pilot plant.

By October 1950, Lundeen had been in the research department for about 4½ years. Three of those, were spent mostly on design and evaluation work. However, Dow felt his talents could best be exploited in the engineering department, and Lundeen certainly didn't object to the broadening process.

First job as a process engineer was a stem-to-stern rehabilitation of a liquid chlorine plant. Lundeen also carried a corollary assignment to enlarge the Western Division's cost estimating procedures. This extra-curricular work led to two well-received cost-estimation articles on rubber lined vessels and centrifugal pump installations co-authored with Bill Clark (Chemical Engineering, March 1955 and August 1955). Lundeen was also project engineer for most of the design and engineering work for Dow's recently completed latex plant at Pittsburg, as well as the project engineering for the Western Division's synthetic fiber plant.

► Worst Specialist—"Though it may seem that I've done a lot of



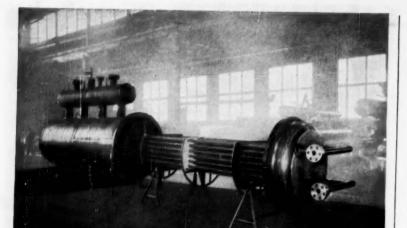
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Wyandotte CHEMICALS

WYANDOTTE CHEMICALS CORPORATION, WYANDOTTE; MICHIGAN . Offices in Principal Cities



Vilter high pressure synthesis condenser fabricated for a prominent chemical company.

Q= How did Vilter cut costs on a High Pressure Synthesis Condenser?

Through practical redesign of the condenser tube lay-out.

A real challenge was tossed at Vilter a short time ago. How to produce a high pressure synthesis condenser to meet design specifications... yet meet the customer's budget requirements.

Originally the customer specified a 72" shell with a return bend type tube bundle of 2" O.D. heavy wall steel tubing. The cost of this design exceeded the budget. After careful study, Vilter engineers solved the problem by changing to smaller centers on the return bends and the use of standard Vilter tube supports. These changes materially reduced the shell diameter without a reduction in vessel capacity. The net result was a price reduction of 15%. This is another example of successful Vilter engineering to meet customer needs.

Vilter makes all four basic types of heat exchangers: shell and coil, shell and tube, shell and tube bundle, and atmospheric... and in every possible modification. Vilter can give you the most efficient heat exchange equipment and pressure vessels with working pressures as high as 10,000 psi for specific purposes. Consult with Vilter.



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Air Units • Ammenia & Freen Compressors • Bootler Compressors • Bootler Coders • Water & Brine Coders • Blast
Freezors • Evaporative & Shoil & Tube Condensors • Pipe Colls • Valves & Filtings • Pakice & Polaritake Ice Machines

NAMES . . .

design work, the emphasis really has been on project organization and management—first as a process engineer and then as supervisor of the process engineering section of the Western Division's engineering department.

"I'm the world's worst specialist—and that covers design, too."

Lundeen's superiors at Dow seem to agree with his own evaluation. In any event, they've kept any opportunity for him to specialize well out of reach. In December 1955, a separate planning department was set up for the Western Division with Lundeen as manager. He handled evaluations of economic environment as well as capital and operating expenditures.

At this point, Lundeen's bailiwick included chemical production, raw material availability, energy resources, plant sites, market studies and competitor activities.

PAside from His Job — Lundeen's wide-ranging interests extend to professional and community activities as well as to his job. Again like Hiester and Nelson, Lundeen came up through the ranks to become chairman of the AIChE's Northern California section. He has also represented the section on the California Legislative Council of Professional Engineers.

Lundeen finds time to give several high school vocational guidance talks every year. His goal is to bridge the gap between education and industry.

"I question seriously whether industry and education are as close together as they ought to be from high school on up. A lot of industrial people don't seem to put as much thought and effort into the business of getting a better understanding of industrial ideas and needs across to the engineering schools as they do to indoctrinating the engineers once they're hired. Unfortunately, there's nothing much anyone person or group of people can do overnight. But, it's essentially a question of initiative not dollars. The most articulate people in the industry must get to know the engineering faculties on an intimate basis, exchange ideas with them

at frequent intervals. There may be a shortage of engineers, but the essential problem is to get better not necessarily more engineers."

As you might expect, Lundeen -the chemical engineer, planner at Dow, the articulate voice among professional chemical engineers-is also a self-styled bur under the saddle of local government. He cut quite a swath for himself a few years ago while serving on various citizen groups on water and sewage problems in the Concord, Calif., area. One colleague offered this crack, "If two people in Concord organize a committee on sewage and water, chances are Lundeen will either be one of them or busy organizing a committee against them."

Lundeen smiles at this but adds seriously, "The 58 special districts in our area just add up to poor business management. The taxpayers have to do something to protect themselves, to get at least a modicum of economy consistent with efficiency. Engineers often give themselves an awful beating when they are silent in the affairs of management—of their company, society or community."

▶ Needs vs. Preferences — "Given my choice, of things to do, I'd be an inveterate reader of historical fiction and Winston Churchill. But with two boys, ten and seven, and a four-year-old girl, sometimes I'm not given my choice."

Sacrifice of leisure time in favor of wide-ranging activities is the price the world's worst specialist pays for his wide-ranging interest. But there's a limit to what can be done; in 1953, Lundeen had to retire from active participation in the Air Force Reserve program.

Robert F. Schultz has been appointed works manager, Maynard L. Parker, production superintendent, and Barrett Brown assistant production superintendent for Hooker Electrochemical Co., in Niagara Falls, N. Y.

Marne Dubs has been promoted to the position of manager of the engineering laboratory at



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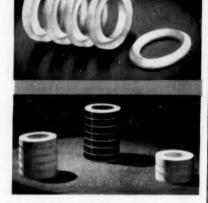
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For manual, air or motor-operated valves. Distinctive tapered V design provides necessary seal at low gland pressure and reduced to the famous Garlock Chevron Packings. Catalog AD-155

Chemiseal Pump Packings-

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Gasket Plastics Division

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NAMES . . .

the Tonawanda, N. Y., labs of Linde Air Products Co.

George Coale has been elected a vice president of National Lead Co. He'll also continue in the position of general manager of the firm's Baroid division, operating from Houston, Tex.



Howard E. Everson

Diamond Alkali's central engineering department has a new chief staff engineer—Howard E. Everson.

Till now, Everson has served as a senior engineer in the central engineering department. He joined the Cleveland firm in 1951 as a senior chemist in research.

Earlier experience includes three years on the faculty of the University of Cincinnati as an assistant professor of chemistry.

Everson is a graduate of Western Reserve University.

Clifford F. Rassweiler, president-elect of the American Chemical Society and vice-chairman of the board, Johns-Manville Corp., has received the 1957 honor scroll of the N. Y. chapter of the American Institute of Chemists.

Harold W. Gear has joined the staff of the chemistry division of Atlantic Research Corp. Howard Niederman has joined the firm's Western division.

James L. Kern has joined the engineering department of Monsanto Chemical's inorganic chemicals division in St. Louis, after six years with Purex Plastics.



Marion B. Geiger

Hooker Electrochemical Co., Niagara Falls, N. Y., has named Marion B. Geiger as director of general development.

Geiger has been general manager, Oldbury Products, since the consolidation of Oldbury Electro-Chemical Co. into Hooker last November. Before that time, he had been executive vice president and a director of Oldbury.

A native of Kentucky, Geiger studied on home grounds at Georgetown College. Later, he earned further degree at MIT and at the University of Michigan.

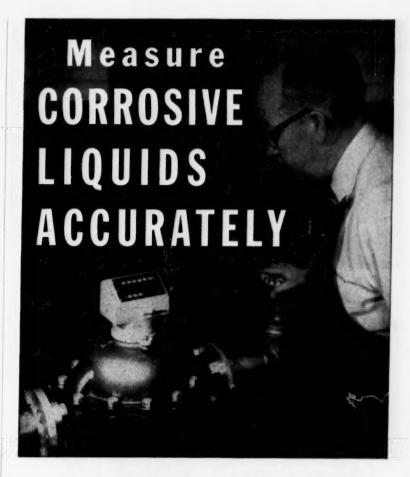


Wade Wolfe, Jr.

Olin Mathieson Chemical Corp. has named Wade Wolfe, Jr. technical liaison manager in the construction engineering department of its high energy fuels organization in Niagara Falls, N. Y.

Primary function will be as liaison with the Air Force in the development, engineering and construction of a high energy fuels plant to be built by the firm at Model City, N. Y.

Wolfe earned a bachelor's degree in chemical engineering at Ohio State University. After three years in the Navy, he re-



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Now you can apply the extreme accuracy of Niagara Meters to the measurement of corrosive liquids. Niagara Chemical Meters of Type 316 stainless steel offer good resistance to corrosion and can be used to measure caustic soda, most acids, fruit juices and similar liquids. Available in sizes 3 to 110 G.P.M. or in intermittent use up to 160 G.P.M. Niagara Chemical Meters are also available for automatic liquid measurement and liquid flow control in hazardous or non-hazardous atmospheres.

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Snap-on Torqueeter* being used to equalize tension to 35 footpounds torque on all nuts used on this Reliance boiler gauge.

Assembly speed . . . Final check Reliance Gauge gets both from



Building water level alarms and indicators requires an extra measure of care and precise quality control — people depend on these instruments. That's why Reliance Gauge Column Co., Cleveland, Ohio, takes every caution in the manufacture of its gauges — and why this company depends on *Snap-on* tools for proper gauge assembly and for final bolt tension checking.

Joseph A. Kyr, Reliance plant superintendent, states, "Snap-on ratchet wrenches and sockets are used by all departments for the sub-assembly of all Reliance flat glass gauges. In the final assembly, Snap-on Torqometers* are used to get even tension distribution on all studs. We find we can depend on these Torqometers* to give us the exact bolt tensions we specify."

The company also recommends to all of its customers the use of a Torqometer* for servicing water gauges.

Got a tool problem? Call the Snap-on man.

If you have a production or maintenance problem involving special tool design or application, or any other question on tools, talk it over with your *Snap-on* man. He's a specialist who devotes all of his time to industrial application of *Snap-on* tools. Write us or call your nearest branch. Free catalog of industrial wrenches and hand tools is yours for the asking.

*Snap-on is the trademark of Snap-on Tools Corporation.

SNAP-ON TOOLS CORPORATION

8106-G 28th Avenue • Kenesha, Wisconsin



NAMES . . .

turned to the School for his master's and doctor's degrees in the same field. He has been with Olin Mathieson since 1949.



R. E. Hulse

National Distillers & Chemical Corp. has elected Robert E. Hulse, general manager of the corporation's chemical division, as an executive vice president.

Hulse joined E. I. duPont de Nemours & Co. in Niagara Falls after earning a Ph.D. at Cornell in 1930. For the next 19 years, Hulse served in various technical and administrative posts until he joined National Distillers as director of research.

Since that time, Hulse has become a vice president of the corporation and has administered the firm's program of diversification into the industrial chemicals field.

H. Hilton Martin Jr., has taken over the newly created position of general manager of Western Chemicals Ltd., whose Alberta, Canada, plant will double expansion this year.

Albert Meilus has been named chief chemist for the lubrication division of Warren Refining & Chemical Co., Cleveland.

Earl A. Long, professor of chemistry has succeeded Cyril S. Smith, professor of metallurgy, as director of the Institute for the Study of Metals, University of Chicago.

M. W. Tamele, associate director of Shell Development's Emeryville, Calif., research center, has accepted an assignment with Shell Research Laboratories in Amsterdam.

E. W. Comings of Purdue's School of Chemical & Metallurgical Engineering, Lafayette, Ind., plans to spend the Fall semester as a Fulbright Lecturer at the Delft Technological University.

Thomas S. Nichols, president of Olin Mathieson Chemical Corp. since the firm's foundation in 1954, is now chairman of the board.

Kenneth N. McLeod, 46, has been named head of the chemistry department at Montana School of Mines, Butte, Mont.

Daniel P. Shedd has joined Mobay Chemical Co. as a sales development specialist, in St. Louis, Mo.

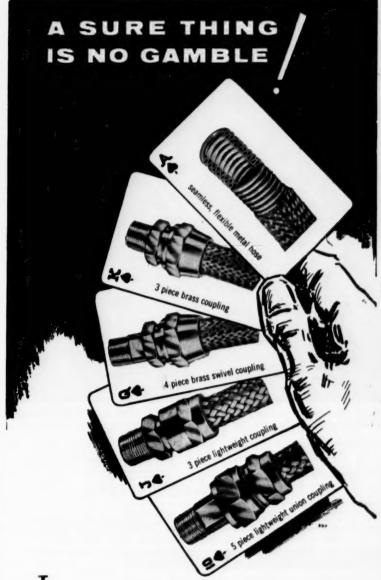


Charles C. Winding

Cornell University has named Charles C. Winding as director of the School of Chemical & Metallurgical Engineering. He succeeds Prof. Fred H. ("Dusty") Rhodes, who retired earlier this month.

Winding will also succeed Rhodes as the school's Herbert Fisk Johnson Professor of Industrial Engineering and will be in charge of the Geer Laboratory for rubber and plastics.

An authority on rubber, plastics, heat transfer and fluid flow, Winding is a consultant for Rome Cable Corp. and B. F. Goodrich. He is co-author of "Plastics, Theory and Practice," published by McGraw-Hill Book Co., and a contributor



In a poker game or in flexible metal hose connectors this hand on hand, means money in your pocket.

The Packless' PATENTED RE-USABLE COUPLINGS are fitted without heat by a simple, clean mechanical process, accomplished in minutes at your plant.

Hand machined of top quality brass, applied and reapplied with ease, Packless* couplings are ideal in excessive movement where heat weakened soldered or brazed joints won't stand up.

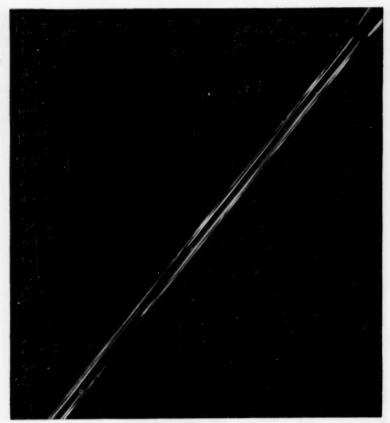
For longest connector life, stock Packless* seamless drawn helical metal hose in random lengths for use as required with Packless* re-usable couplings. Sizes from $\frac{1}{4}$ " to $1\frac{1}{2}$ " I.D.

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Using stop motion, photographer Bernard Hoffman 'freezes' a tiny jet of water. Discharged at high pressure, the stream is a solid, unwavering mass.

Controlling Pressure in Fluid Engineering

Pressure is always a problem . . . either how much you need, or what you can do in spite of it. Accurate control requires the relation of other factors, like volume, time, and resistance. To get these answers, you can depend on the engineering leadership of S. Morgan Smith.

Take butterfly valves. Parts for a wide range of standard R-S Butterfly Valves, capable of satisfying most processing requirements, are carried in stock for fast assembly and shipment. These R-S Valves, with their streamlined vanes, give you minimum pressure drop, save pumping power. Regulation and closure are quick, and you get uniform flow control through all positions in the normal regulating range.

To obtain full information on the complete SMS line-R-S Butterfly Valves, Rotovalves or Ball Valves-call our nearest representative. Or, write S. Morgan Smith Co., York, Pa., for data on standard valves or special applications.





AFFILIATE: S. MORGAN SMITH, CANADA, LIMITED, TORONTO

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to the "Handbook of Engineering Materials."

A native of Minneapolis, Winding earned a B. S. as well as a doctorate in chemical engineering from his home town's University of Minnesota.



Michael Markels, Jr.

Atlantic Research Corp. has appointed Michael Markels to head up its newly setup nuclear engineering activities. Till now, Markels was manager of heat transfer operations of the Columbia University heat transfer research facility.

Markels comes to Atlantic Research after 5 years with the Columbia facility where he directed the design, construction, and operation of a full-scale mock-up of nuclear reactor fuel elements for heat transfer and fluid flow measurement.

A member of the AIChE, Markels holds a doctor of engineering science degree in chemical engineering from Columbia. Before his assignment at the University, he was an engineering technologist at Shell Oil's Wood River, Ill., plant.

- A. P. McCue, operating superintendent of the Westvaco, Wyo., operations of Intermountain Chemical division of Food Machinery & Chemical Corp. has been transferred to New York.
- M. E. Paradise, Hoffman Electronics Corp. vice president in charge of Midwest operations, has been named general manager of the company's new Hoffman Solar division, Evanston, Ill.



Frank W. Silva

B. F. Goodrich Chemical Co. has appointed Frank W. Silva as technical service manager for associate company relations. The firm's associate companies are located in England, Brazil, Mexico and Japan.

Silva received a B. S. in chemical engineering from Purdue University in 1939. That year, he also joined B. F. Goodrich in Akron, Ohio. By 1946, he became technical manager at the Louisville plant and, five years later, plant engineer for the Louisville chemical installation.

In 1953, Silva supervised the construction of Geon do Brasil—the first plant to produce polyvinyl chloride in Brazil. From April 1955 until the present time, he was director of the plant.

John C. Linsenmeyer has been elected an executive vice president, operations, of American-Standard. He'll take charge of a group of operating divisions producing industrial and engineered products.

The Manufacturing Chemists'
Ass'n has granted \$1,000
college chemistry teacher
awards to: Emil Ellingson,
St. Olaf College; Leo Yanowski, Fordham; John Turkevich, Princeton; Garrett
Thiessen, Monmouth College;
Arthur Scott, Reed College;
and Ashley Robey, Roanoke
college.

Earle F. McSpadden, Jr. will be field project manager in charge of construction of the multi-million dollar cello-



Tolhurst centrifugal saves 16 manhours a day

A Tolhurst Batch-Master centrifugal is now processing the same volume of fine organics in 8 hours as 2 other centrifugals formerly did in 24 hours. These results, illustrated graphically, occurred in a leading chemical plant.

Tolhurst Batch-Master

2 former centrifugals

HOURS 8	PER DAY TO DO SAME JOB	24
	Savings: 16 manhours a day	
	(I man ran both centrifugals)	

Unloads in 30 seconds

Tolhurst's hydraulic unloader and bottom discharge unload the solids in 30 seconds. Other batch centrifugals, under identical conditions, take 15 minutes or more.

Batch-Master with hydraulic unloader

Other batch centrifugal with manual unloading

1	2 3	4 5	DING TIME IN MINUT	ES 15
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American Machine and Metals, Inc.

Specialists in liquid-solids separation

Dept. CET-757, EAST MOLINE, ILLINOIS

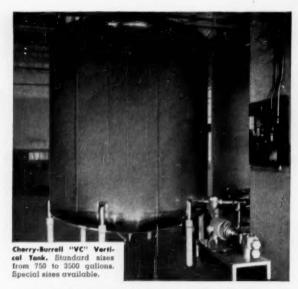
Send your new free 4-page Bulletin TC-14-56 giving full data on Batch-Master Centrifugal.

NAME AND TITLE

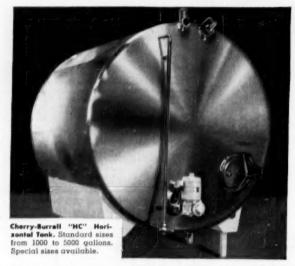
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Which stainless steel tank



should you put in your plant?

Your plant layout may determine which Cherry-Burrell Tank best fits your needs. It's just a question of space since both tanks store, mix, heat and cool a variety of products.

Both models feature all-welded 18-8 stainless steel, No. 4 inside finish with welds ground smooth; bright finish outside, with welds wire brushed.

Both models can be provided with agitators to do your job. Vertical tanks offer choice of standard dish or reverse dish bottom for easy drain.

Accessories include built-in germicidal lamps, sanitary gauge glasses, thermostats, auto-level controllers, channel wall surface for heating and cooling.

For further information, see your Cherry-Burrell
Representative, or write for Bulletin G-506.

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SALES AND SERVICE IN 58 CITIES — U. S. AND CANADA

NAMES . . .

phane plant to be built by Du Pont near Tacumseh, Kans. Myron Morrison will assist McSpadden.

W. L. McDermott, of Dow's economic evaluation department, has been transferred to the Louisana division where he'll work in the production coordination group.

Edgar B. Chiswell has been appointed executive secretary of California Chemical Co., subsidiary of Standard Oil Co. (Calif.)



Edwin G. Koch

Montana School of Mines' Edwin G. Koch—professor of chemistry—has been named president of the college.

Before joining the faculty at the Montana school in 1946 he taught for some years at the University of Tennessee in Knoxville and at the University of Texas. He earned his own degree in 1932 at the University of Illinois.

At various times, Koch has been employed as a research chemist by Hercules Powder Co., Shell Oil Co., Amalgamated Sugar Co. and Atlas Powder Co.

Glen McIntyre has been elected president of Horizons Titanium Corp., succeeding C. A. Specht—who will now devote full time to his duties as chief executive officer of Minerals & Chemicals Corp. of America.

James D. Larkin has joined the research department of Monsanto Chemical Co.'s plastics division at Springfield, Mass. His former chemical engineering duties were with Ethyl Corp.

OBITUARIES



Joseph W. Kennedy

Chairman of the department of chemistry at Washington University—Joseph W. Kennedy—died May 5 of cancer at his home in a suburb of St. Louis, Mo. He was 40 years old.

Kennedy was one of the four scientists to discover plutonium. He helped develop the separation process for the element (along with Glenn Seaborg and others) while still a chemistry instructor at the University of California. Then, in 1943, he moved to UC's Los Alamos scientific laboratory where he continued his work as head of the chemistry and metallurgy division.

For the past two years, Kennedy had been under the doctor's care. He continued his research at the university, however, in the hope that some of it would be of aid in the treatment of cancer. Kennedy's physician claims that there is no connection between his illness and his work on atomic energy.

David L. Ginsburg, 58, of Denver, died April 27. He was vice president of Kawl Paint Co. and secretary-treasurer of Scientific Supply Co.

Charles C. Cheyney, vice president of Buffalo Forge Co. since 1953, died Thursday evening in University Hospital, Syracuse, N. Y., following a heart attack.

CORROSION

TYPE	HOW TO IDENTIFY						
GALVANIC	Localized deep grooves or pits, often at contact between dissimilar metals.						
UNIFORM	Uniform attack—may be on only one part.						
INTERGRANULAR	Attack at grain boundaries.						
PITTING	Rapid, deep pitting at several small areas. May be uniform or highly localized.						

Why you can conquer all four kinds of corrosion with Goulds chemical pumps

When you buy Goulds Fig. 3715 chemical pumps you can build *specific* protection against all four types of corrosion.

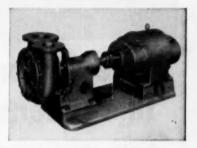
Match the pump metal to your liquids. You can have the *entire* fluid end of the pump made of 316 stainless, Gould-A-Loy 20, nickel aluminum bronze, iron, iron with stainless trim or nickel aluminum bronze trim. These metals from stock. Any machinable alloy on application.

All machined parts in all metals held to same close clearances permitting economical alloy changes in the field . . . the entire liquid end or any component as conditions warrant.

Choosing from this wide range of metals, you can combat the different corrosive actions of hot acids, alkalies, slurries, sizes, or whatever other corrosive liquids you pump.

Match pump size to job

You can get Goulds Fig. 3715 in 9 sizes: capacities to 720 GPM, heads to 200 ft. Other features of Fig. 3715: water-jacketed support head permits handling liquids at 350°E; impeller clearance can be adjusted without dismantling the pump. For more information, write for Bulletin 725A.



These larger pumps also fight corrosion

For larger capacities or heads, you can get these other Goulds pumps in metals that resist specific corrosion:

Fig. 3405—single stage, double suction; 19 sizes; capacity to 6400 GPM, head to 425 ft. Bulletin 721.6. Popular sizes available in 316 stainless steel from stock.

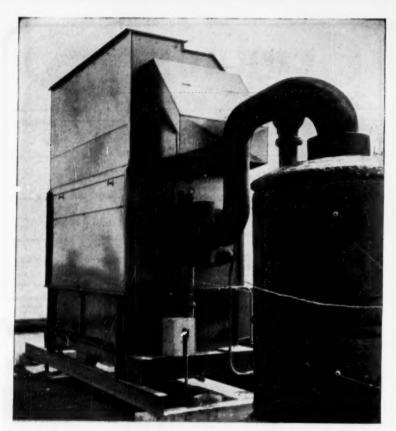
Fig. 3305—two stage, opposed impellers; 8 sizes; capacity to 1200 GPM, head to 1000 ft. Bulletin 722.6.

Fig. 3189—single stage, open impeller; 11 sizes; capacity to 1080 GPM, head to 180 ft. Bulletin 720.4.



Branches: Atlanta - Boston Chicago - Houston New York - Philadelphia Pittsburgh - Tulsa

West Coast Representative: Goulds Pumps Western, Portland, Ore.
In Canada: The A. R. Williams Machinery Co., Ltd. in all principal cities.



Save Water and Power in Condensing Vapors

● NIAGARA AERO VAPOR CONDENSERS give sustained full capacity in condensing vapors by evaporative cooling with only nominal use of water. You have no problems of water availability or disposal, or quality, or temperature.

Non-condensibles are effectively separated and subcooled, giving better vacuum pump operation. Liquids and vapors are always held at constant temperatures. Cooling effect is directly proportional to the load. You get uniform distillation products the year round. You get better quality control and higher production. You save power and steam. Capacities up to 30 million BTU.

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Ask for Bulletin 129R.

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New York 17, N. Y.

District Engineers in Principal Cities of U.S. and Canada

PEOPLE . . .

FIRMS IN

NEW COMPANIES

Olin Mathieson International Corp. is new company that will be responsible for Olin Mathieson Corp.'s overseas activities.

Texas Nuclear Corp., Austin, Tex., has been formed to offer physics research and consulting services. Firm recently installed a 2-million-volt Van de Graaff particle accelerator purchased from High Voltage Engineering Corp.

Fitzpatco Corp., Chicago, Ill., newly created division of W. J. Fitzpatrick Co., is sales and service agent for Manesty Machines Ltd., Liverpool, England, maker of pharmaceutical and allied machinery.

Surfacto Co., Blue Island, Ill., has been formed to conduct operations in the detergent and chemical specialty fields. Firm offers raw materials and consultation service.

California Chemical Co. is newly formed company to consolidate the chemical activities of Standard Oil Co. of California.

Westdahl Instrument Co., newly established instrument firm, is located in Millington, N. J.

NEW LINES

Armour & Co.'s chemical division is introducing a new line of all-weather asphalt antistripping agents: Redicote 75, 2323 and 2370.

Union Carbide Chemicals Co., this summer, is marketing its "6-12" insect repellent in aerosol cans on a nation-wide scale.

Hart Products Corp., New York, is adding three new products to its line of thermosetting textile resins. Products are Hartoresin S-50, Hartoset F-60, both urea-formaldehyde

THE NEWS

resins, and Softolene A, a synthetic-wax emulsion.

Werner G. Smith, Inc., Cleveland, Ohio, is setting up a new division in Cleveland to expand its line of spermwhale, fish and core oils.

NEW NAMES

National Distillers & Chemical Corp. is the new name of National Distillers Products Corp.

Pennsylvania Salt Mfg. Co. has changed its name to Pennsalt Chemicals Corp.

Union Carbide & Carbon Corp. has changed its name to Union Carbide Corp.

Union Carbide Chemicals Co. is the new name of Carbide & Carbon Chemicals Co.

Linde Air Products Co.'s new name is Linde Co.

NEW FACILITIES

Food Machinery & Chemical Corp. will double capacity of its South Charleston, W. Va., carbon tetrachloride plant by early 1958.

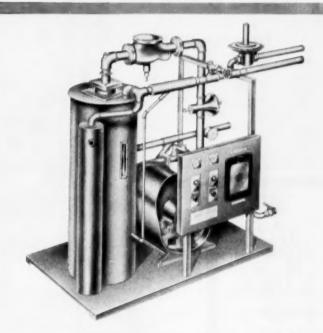
Total of 17 oil companies have decided to build an 800,000bbl./day pipeline from Middle East to Mediterranean, probably via Turkey. Capacity may be boosted later to 1.4 million bbl./day.

Gas-Ice Corp. of Portland, Ore.
owns and operates a new
\$300,000 plant to make liquid
carbon dioxide and dry ice at
Finley, Wash. Plant is supplying AEC's nearby Hanford
Works.

Trionics Corp. has set up a new laboratory in Madison, Wis., to offer research and development services in such fields as high- and low-tem-

THE NEW SUB-X INERT GAS GENERATOR

by THERMAL



A compact... economical source of inert gases

THERMAL'S SUB-X generator offers unsurpassed operating economy and efficiency. Its unique design utilizes submerged exhaust of combustion products and permits the use of river water or other low-cost water supply as coolant.

The SUB-X generator is built around the THERMAL burner which can be fired with gas or distillate oil. Because of the burner's high heat release characteristics, the SUB-X generator eliminates refractory and reduces mainte-

nance costs. Each unit is supplied as a complete package with all control and safety equipment. Standard models are available in capacities up to 35,000 SCFH of inert gas. Larger capacity units can be designed to your specifications.

WRITE FOR BULLETIN #114



OTHER THERMAL PRODUCTS & SERVICES

Gas, Oil, Combination Burners • Heat Exchangers • Submerged Combustion • Air Heaters • Combustion and Heat Transfer Engineering



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REPRESENTATIVES IN PRINCIPAL CITIES



SURE Darling gate valves are available in the metals or special alloys needed for your particular service . . . and you ought to look into the hard rubber lined iron body type for possible savings. But beyond all that is where the real plus-value begins—the result of Darling's fully revolving double disc parallel seat principle!

This principle assures uniform wear distribution, automatic seating compensation, and avoidance of disc-to-seat galling. It means prolonged tight closure, much less maintenance and far less chance of process interruptions!

It's easy to get all the facts on Darling plus-values. Just ask for new Catalog No. 57.

ENGINEERING SERVICE: Darling offers unusual facilities for the development and manufacture of special valves for out-of-the-ordinary requirements. This special service is available to you at all times, without obligation.

DARLING VALVE & MANUFACTURING CO.

Williamsport 3, Pa.

Manufactured in Canada by Sandilands Valve Manufacturing Co., Ltd., Galt 19, Ont.





perature-resistant materials, ceramics, coatings and surface treatments, plastics and metallurgy.

H. K. Porter Co. has acquired Federal Wire & Cable Co., Ltd., Guelph, Ont.

Procter & Gamble Co. has acquired the assets of Clorox Chemical Co.

Heyden Newport Chemical Corp. will build a research laboratory at Pensacola, Fla., to house research toward developing emulsifiers, antioxidants, accelerators, retarders and other specialties for synthetic rubber.

Humble Oil & Refining Co, will spend about \$1.5 million to expand its Houston, Tex., research center.

U. S. Rubber Co. is constructing a new sales branch office and warehouse at Dallas, Tex. Building will be completed early this fall.

Electronic Associates, Inc. is setting up a new European sales office on Rue de la Science, Brussels, Belgium. EAI produces general-purpose analog computers.

Air Products, Inc. will build two liquid oxygen plants for the U. S. Army Corps of Engineers. Each plant will make 50 tons/day of oxygen for guided missile propellants, can be dismantled and carried in cargo aircraft.

Surpass Petrochemicals, Ltd. last month placed on stream its new \$1-million petroleum sulfonates plant at Sarborough, Ont.

Escambia Chemical Corp. is building a 50,000-sq.-ft. research center in Wilton, Conn., to conduct research in petrochemicals, plastics and related fields.

Stauffer Chemical Co. this month will complete a several-thousand-dollar addition to its Richmond, Cal., laboratory. Stauffer will step up research on special metals, high-energy fuels and inorganic plastics.

Callery Chemical Co., building its \$38-million high-energyfuel plant at Muskogee, Okla., will let the contract for third phase of construction, which includes first process units, about Sept. 1.

Neptune Meter Co., manufacturer of industrial control equipment, has acquired 50% interest in Hot Spot Detector, Inc., Des Moines, Iowa.

Cleveland, Ohio, will get a more-than-\$1.5-million Engineering and Scientific Center to house facilities for more than 53 engineering and technical groups. Building is expected to be occupied in the summer of 1958.

Sterling Drug, Inc. has acquired Thomasset Colors, Inc., Newark, N. J., maker of phthalocyanine blue and green pigments and a line of drug and cosmetic colors,

Candle-Lite Cincinnati, Ohio, has purchased Parawax Div. from Standard Oil Co. (Ind.), will move manufacturing from Whiting, Ind., to Leesburg, Ohio.

Peck's Products Co., St. Louis, Mo., has acquired sales rights, manufacturing rights, formulas and inventories of Olin Mathieson Chemical Corp.'s soap business.

Houilleres du Bassin de Lorraine has contracted Societe Belge de l'Azote of Liege, Belgium to build an acetylene plant at Carling in the Moselle.

Kerr-McGee Oil Industries, Inc. will add more than \$4 million worth of process equipment to its Wynnewood, Okla., refinery. Contract has been awarded to Refinery Engineering Co., Tulsa.

Engelhard Industries, headquartered in Newark, N. J., has opened a plant in Rome to manufacture precious-



You pay less for this stronger thread for bags



"SUPER CORDURA" SEWING THREAD reduces bag breakage resulting from rugged handling, because seams are much stronger.



"SUPER CORDURA" can be sewn with smaller needles, preventing material losses caused by sifting.

HIGHLY EFFICIENT "SUPER CORDURA" REDUCES BAG AND CLOSING COSTS

GREATER seam strength, increased sewing efficiency, lower cost—these are the advantages of sewing bags with Du Pont "Super Cordura"* high tenacity rayon.

Because "Super Cordura" is far stronger than ordinary-fiber threads, danger of seam breakage is minimized—drop tests prove it. And because sewing with "Super Cordura" is more efficient, you save money in your closing operations. There are less breaks during closing; one thread does most jobs, reducing thread inventory.

Consider the advantages of bags sewn with Du Pont "Super Cordura" the next time you order multiwalls . . . and order it for use in closing, too.

E. I. du Pont de Nemours & Co. (Inc.), Textile Fibers Department, Wilmington 98, Delaware.

""Super Cordura" is Du Pont's registered trademark for its high tenacity rayon yarns.



Better Things for Better Living . . . through Chemistry

THREAD OF "SUPER CORDURA"...easier to sew ... costs less than conventional thread . , . extra-strong



Cambridge offers you complete wire cloth fabrication facilities

From giant retaining screens for catalysts or filter media to small strainer assemblies for Diesel engines, fabrication of wire cloth parts to a wide variety of demands is a daily operation at Cambridge. Whatever your needs . . . filter leaves, strainers, sizing screens, retaining screens . . . you can rely on Cambridge for quality and prompt service. We'll work from your prints or draw up prints for your approval.

IF YOU BUY WIRE CLOTH IN BULK,

we can give you immediate delivery from stock on large or small orders from the most frequently used types of cloths . . . from the finest to the coarsest mesh.

Accurate mesh count and uniform mesh size are assured by individual loom operation and careful inspection just before shipment.

Let us quote on your next order for wire cloth. Call your Cam-bridge Field Engineer—he's listed under "Wire Cloth" in your classified telephone book.

full range of wire cloth available. Describes fabrication facilities and gives use-ful metallurgical data.



The Cambridge Wire Cloth Company

WOVEN WIRE CONVEYOR BELTS

CLOTH **FABRICATIONS**

DEPARTMENT G, CAMBRIDGE 7, MARYLAND

OFFICES IN PRINCIPAL INDUSTRIAL CITIES

metal catalysts and liquid gold for ceramic decoration.

Richfield Oil Corp. will build a \$55-million, 50,000-bbl./day refinery near Everett, Wash., when Pacific-northwest sales reach 35,000 bbl./day. Tentative on-stream date: 1965.

National Cylinder Gas Co. has placed on stream at Jackson, Miss., a commercial oxygen, nitrogen and acetylene plant.

British Petroleum is replacing existing crude distillation unit with a larger one at its Grangemouth refinery in Scotland, will boost capacity from 44,000 to 62,000 bbl./day.

General Aniline & Film's Ozalid Div. is constructing a \$1-million plant near Los Angeles. Cal., to make sensitized materials. Plant is expected on stream in about a year.

Kermac Nuclear Fuels Corp., controlled by Kerr-McGee Oil Industries, will build a 3,300ton/day uranium mill in Ambrosia Lake area of New Mexico. AEC has contracted to buy ore through 1966.

A. R. Maas Chemical Co. has nearly completed its plant at South Gate, Cal., for making Questex sequestering agents (a group of ethylene diamine tetraacetate products).

Northwest Nitro-Chemicals is already planning to sink \$150,000 into expansion at its 6-mo.-old, \$22-million fertilizer plant at Medicine Hat in southern Alberta. Plant is now at capacity: ammonium nitrate, 35,000 tons/yr; ammonium phosphate, 65,000 tons/yr.; ammonium phosphate-sulphate, 42,000 tons/

Air Reduction Chemical Co. will build U.S.'s first plant to produce commercial quantities of vinyl stearate at Calvert City, Ky. New 2-million-lb./ yr. plant will use Airco-developed process.

Aluminum Co. of America will build a new research and development center in a rural area 28 mi. east of Pittsburgh, Pa.

Permanente Cement Co. has dedicated its 2.5-million-bbl./ yr. cement plant near Lucerne Valley, Cal.

Texas Portland Cement Co. is upping capacity at its \$6million Orange, Tex., cement plant by 2,000 to 4,000 bbl./ day—a boost of about 15%.

Mellon Institute, according to a joint announcement with Union Carbide Chemicals Co., will build a 30,000-sq . ft. building for the Chemical Hygiene Fellowship at Mellon's Bushy Run Laboratories in Penn Township, Penn.

Pittsburgh Coke & Chemical's Industrial Chemicals Div. has double phthalic anhydride capacity at its plant on Neville Island on the Ohio River below Pittsburgh, by adding new \$3-million facilities.

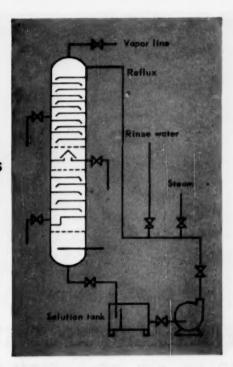
Chemical Process Co., Redwood City, Cal., has tripled capacity of Dion polyester resins and new Dion isophthalic resin.

Davison Chemical Co. will start commercial-scale production this year of polyolefin catalyst (under license from Phillips Petroleum Co.) at a new plant now under construction at Cincinnati, Ohio.

U. S. Rubber Co. has acquired a large minority share in Englebert & Co., Liege, Belgium. USR gets manufacturing facilities in Belgium, France and Germany.

Dow Chemical Co.'s Texas Div. is building a second glycerine unit at its Freeport, Tex., plant. Unit, to be on stream next March, will double Dow's present glycerine capacity.

Hoffman Electronics Corp., Los Angeles, has established the Hoffman Solar Div. to work on development and production of solar energy converters. New division will he Towers...
Tanks
Pumps
Compressors
Exchangers
Condensers
Lines
Fittings
Valves



Clean them fast the Oakite way ... chemically!

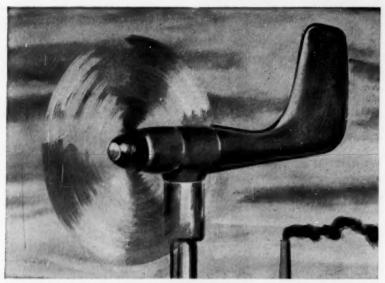
Now you can clean process equipment without dismantling ... without scraping, rodding, sandblasting ... without lengthy off-stream breaks in production.

The new quick way is by in-place chemical circulation, using Oakite specialized materials and methods. Those tough deposits that form in the manufacture of such chemicals as acetylene, polyethylene, carbon tetrachloride, glycols, synthetic resins—to name just a few—are removed speedily, safely, at low cost.

Savings that can result are impressive. Talk the subject over with your local Oakite Technical Service Representative, or write for technical bulletin to Oakite Products, Inc., 16H Rector Street, New York 6, N. Y.



Technical Service Representatives in Principal Cities of U. S. and Canada



The Aerovane Transmitter detects wind speed and direction, electrically transmits data to indicator and recorder, and actuates control mechanism.

BENDIX AEROVANE* SYSTEM HELPS SOLVE AIR POLLUTION PROBLEMS



Indicator shows wind speed and direction. Calibrated in compass degrees and miles per hour.



Recorder inks wind speed and direction on time-calibrated chart. At normal setting, operates continuously for twoweek period.



Optional Indicator-controller reduces operating cost of blowers, deodorizers and scrubbers by providing automatic on-off control.

Here's how you can relieve air pollution problems in connection with your plant—and, incidentally, save your company endless headaches. The Bendix-Friez Aerovane System can be of tremendous value to you in eliminating costly and bothersome litigation, saving you money and building good public relations in the community where your plant is located.

If your stacks emit an odorous or possibly dangerous effluent, you must take steps to prevent it from harming personal health, crops or residences in the surrounding area. Bendix-Friez Aerovane System can help do the job as economically as possible.

Here's how it works. When winds are from an unfavorable quadrant, and blowing at velocities which indicate the likelihood of injurious fall-out, your Aerovane System goes to work. It actuates your blowers, deodorizers and scrubbers only when conditions require their use. At the same time, the Aerovane Recorder keeps a continuous and accurate, permanent record of both wind direction and speed. If litigation does develop, you'll have unquestionable evidence of wind conditions at any given hour.

In addition, the recorder provides an oppor-

In addition, the recorder provides an opportunity for the study of wind gustiness, an important factor in predicting the behavior of an effluent from a stack.

These are just a few of the reasons why you ought to investigate the Bendix-Friez Aerovane System if you have a factory-based pollution problem. Write today for full details. Bendix-Friez, 1418 Taylor Avenue, Baltimore 4, Maryland.

*REG. U.S. PAT. OFF.

Friez Instrument Division



FIRMS . . .

headquartered in Evanston, Ill.

Case Institute of Technology has selected a 275-acre site in Glenwillow Village near Cleveland, Ohio, for the proposed \$7-million Case Industrial Nuclear Center. Heart of the facility will be a highflux engineering test reactor.

Delhi-Taylor Oil Corp.'s new chemical division placed its \$4-million petrochemical plant on stream at Corpus Christi, Tex., the first of this month.

Raybestos-Manhattan, Inc., has finished a new testing and development laboratory at its plant in Stratford, Conn. Lab will test lines of adhesives, coatings and sealers.

Chicago Rawhide Mfg. Co.'s Sirvene Div. has opened a new special-polymer section at its Elgin, Ill., plant.

Panama Refining & Petrochemical Co., Panama City, has signed a contract with Foster Wheeler Corp. for design and construction of a \$33-million, 55,000-bbl./day refinery at Colon, Republic of Panama. Work is getting under way now, and refinery should be on stream in less than two years.

van Ameringen-Haebler is building a new administrative building at its Union Beach, N. J., plant.

Stanford Research Institute has awarded a \$3,200 contract to Tibbs Construction Co., Palo Alto, Cal., for a 35-ft. solar furnace to be located at Menlo Park, Cal.

Mississippi Valley Portland Cement Co. will build a \$3.7-million, 680,000-bbl./day cement plant near the Yazoo River north of Vicksburg, Miss. Production is scheduled to start next spring.

Homestake-Sapin soon will start constructing a \$9-million uranium mill in the Ambrosia Lake area of New Mexico. Homestake-Sapin is limited partnership formed by Homestake Mining Co. and Sabre-Pinon Corp.

NEW REPRESENTATIVES

Union Asbestos & Rubber Co.
has appointed Precision Insulation Co., Houston, Tex.,
as a distributor for Unibestos
fibrous high-temperature insulation.

McWhorter Chemicals, Inc., Chicago, has appointed Carl A. Lechner Co. as new sales agent for Illinois (excepting Chicago), Indiana, western Michigan and eastern Iowa.

Automatic Switch Co., Florham Park, N. J., has appointed Lakeland Engineering Co., Minneapolis, Minn., as stocking distributor of Asco solenoid valves.

Lachat Biochemical Co. has been appointed representative in the Chicago area for Columbia Organic Chemicals Co., Inc.

Olin Mathieson's Industrial Chemicals Div., will market all of the chlorine output of the new chlorine-caustic soda plant being built by Kaiser Aluminum & Chemical Corp. at Gramercy, La.

NEW LOCATIONS

Industrial Chemicals Div. of Olin Mathieson has moved its St. Louis district sales office to 8000 Bonhomme St., St. Louis, Mo.

Blaw-Knox Co.'s Chicago, Ill., office is now located at 36 S. Wabash Ave.

Alco Products, Inc. has moved its Pittsburgh, Pa., district office to Greentree and Cochran Roads in the suburban South Hills section.

Texas Instruments Inc.'s semiconductor-components division has moved its marketing offices to 2929 Cedar Springs Road, Dallas, Tex.



For the Practical Answer to Your Heat-Exchange Problem...

There is a competent Aerofin heat-transfer engineer near you, qualified by intensive training and long experience to find the *right* answer to your own particular heat-exchange problem.

This specialized knowledge is there, ready for you to use to your greatest advantage. Ask the Aerofin man — and be right.



Aerofin is sold only by manufacturers of fan-system apparatus. List on request.

West End anhydrous SODIUM SULFATE merits your confidence for its consistent purity

Here is the new high standard of sodium sulfate quality achieved by exclusive West End production techniques and controls. The product is pure white and exceedingly low in heavy metal content. It is guaranteed 99½% minimum Na₂SO₄ yet actually runs 99.75% to 99.8% Na₂SO₄ typically. We invite your attention to the adjacent typical analysis and welcome your communication.

TYPICAL ANALYSIS

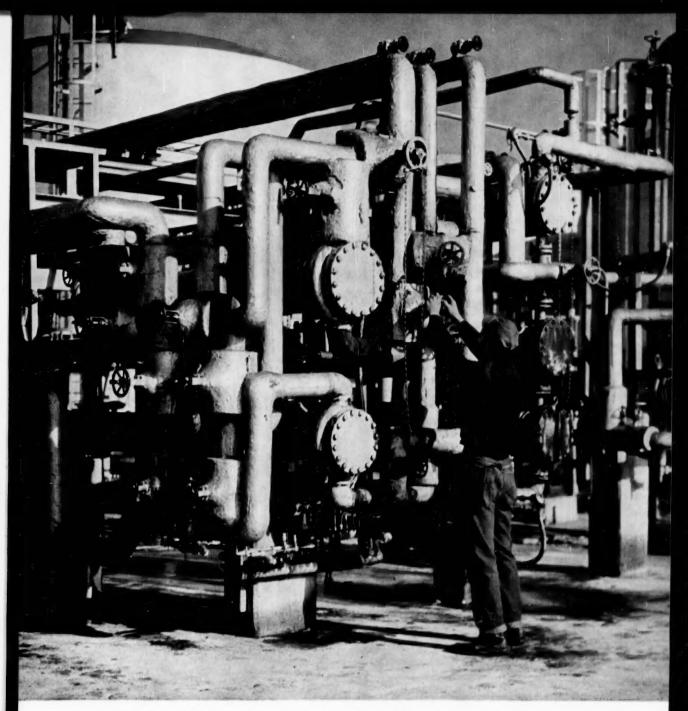
Na ₂ SO ₄		9	9.	5 9	%	or	better
Na ₂ O					05	%	max.
B_2O_3					05	%	max.
NaCl					07	%	max.
Insoluble							Trace
Loss on ignition .		L	ess	: 1	ho	ın (0.1%
Solution .							
Color						. 1	White
Fe						. 1	ppm
As						11/2	ppm
Cu&Zn .			N	ot	de	ete	ctable





West End Chemical Company

EXECUTIVE OFFICES, 1956 WEBSTER, OAKLAND 12, CALIF. PLANT, WESTEND, CALIF.
SODA ASH . BORAX . SODIUM SULFATE . SALT CAKE . HYDRATED LIME



Easy way to keep tall oil moving: Aloyco jacketed valves

You're looking at a portion of the recently completed tall oil fractionation plant Foster Wheeler built for Union Bag-Camp Paper Corporation near Savannah, Ga.

The jacketed Aloyco stainless steel valves (with red hand wheels) get quite a workout in the two stage fractional distillation process here. Rosin and an intermediate fatty acid are produced in the first stage. Then the fatty acid is rerun through the main fractionating tower to produce a refined product for the

manufacture of high grade alkyd resins, processing oils, soaps and chemical intermediaries.

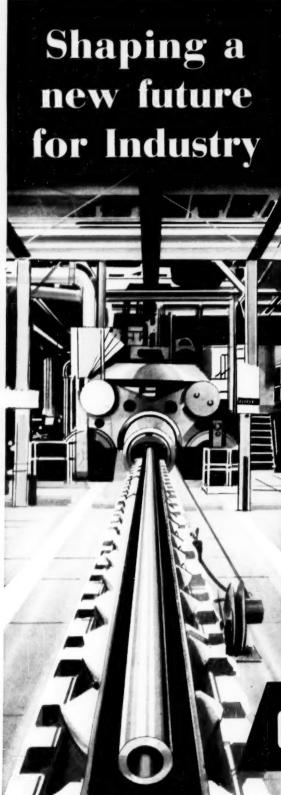
Completely jacketed Aloyco valves are designed to ease handling of tars, tar oils, rosins and other materials difficult to move at room temperature.

Aloyco's integrally cast, completely jacketed valves insure long life and low maintenance in high temperature corrosive service. For more information, write Alloy Steel Products Co., 1301 West Elizabeth Ave., Linden, N. J. 71





ALLOY STEEL PRODUCTS CO., LINDEN, NEW JERSEY





CURTISS-WRIGHT extrudes steels in shapes, lengths and sizes never before possible

Curtiss-Wright's Metals Processing Division is pushing steels into new uses for all industries. Shapes and sizes never before possible are being extruded in constantly increasing tonnages from alloy steels, stainless, titanium and other metals.

Starting with billets weighing up to 9000 pounds, the world's largest horizontal steel extrusion press moves the metal into shapes of virtually any profile that can be circumscribed by a 20-inch circle. Or, in a matter of seconds, the raw material may become heavy wall tubing up to 22 inches in diameter.

The 12,000 ton extrusion press and the complete facilities of Curtiss-Wright's Metals Processing Division are ready to go to work for you . . . to advance the design and production of metal products beyond the limitations of conventional equipment. Qualified engineering consultation available at all branch offices.

75 GRIDER STREET

CURTISS-WRIGHT

Metals Processing Division Branch Offices: New York • Houston • Los Angeles



They look like twins... but one is synchronous



Louis Allis "SYNCRO·SPEDE"* offers...for the first time...a synchronous motor in the same frame sizes as a standard induction motor

New from Louis Allis — the most compact and efficient synchronous induction motor on the market ... the revolutionary "Syncro-Spede." It's the only synchronous motor built in standard NEMA frames for comparable ratings in any enclosure.

The space-saving "Syncro-Spede" has no external excitation, wound rotating fields, collector rings or brushes—offers simplified control and low-cost operation. And it's virtually maintenance-free.

In performance, "Syncro-Spede" delivers and maintains exact synchronous speed within its rated capacity, regardless of load variations or voltage dips. When "Syncro-Spede" motors of several different ratings are powered by a single adjustable-frequency

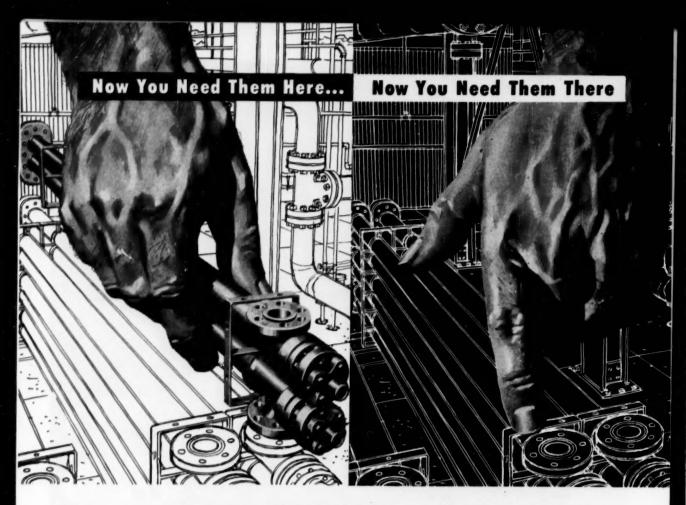
source, their acceleration, running speed, and deceleration can be synchronized.

"Syncro-Spede" is the low-cost answer to such demanding synchronous applications as precise adjustable-frequency multi-motor systems...high-frequency generator drives and constant-speed conveyor drives... precision timing and metering devices... recording instrument drives... any system requiring constant speeds from no-load to full-load.

"Syncro-Spede" sizes range up to 100 hp. For information and expert application engineering assistance, contact your nearby Louis Allis District Office or write directly to The Louis Allis Company, 447 East Stewart Street, Milwaukee 1, Wisconsin.

•"Syncro-Spede" is a trademark of the Louis Allis Co.

LOUIS ALLIS



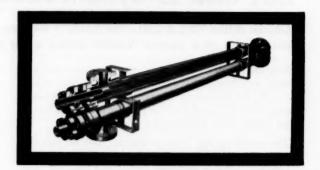
You Can Move ALCOTWIN Heat Exchangers as Loads and Processes Change

The flexibility of ALCOTWIN® heat exchangers means that you can change load or processes within your plant and still use the same heat-exchange equipment. You can easily add new ones for increased load, or you can rearrange present ones for changing conditions. They never become obsolete because of their unlimited number of applications.

ALCOTWINS are in stock in Beaumont, Texas, for immediate delivery when you need them. They are available off the shelf in a number of sizes, for pressures up to 600 psi and temperatures to 650° F.

You get real economy in first cost, in ease of installation and maintenance. In addition, you can select the precise metallurgy needed for best results in your application. The ALCO gas shielded tungsten arc welding method of fusing the fins to the tube permits the widest possible range of metallurgy.

Complete information is available from any of ALCO's sales offices. For a copy of Bulletin FH-3, write Petroleum Industry Equipment Division, Dept. AW-3, P. O. Box 1065, Schenectady, New York.





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Locomotives · Diesel Engines · Nuclear Reactors · Heat Exchangers · Springs · Steel Pipe · Forgings · Weldments · Oil-Field Equipment

How to evaluate materials of construction for the chemical plant

Choosing materials of construction for chemicalindustry equipment is a complex job. The first step toward the solution of a new problem is the analysis of all the requirements that can be anticipated. If they indicate one or more of the properties shown, chances are that Crucible stainless steel is the most practical choice you can make.



RESISTS CORROSION — Stainless is almost impervious to attack by oxidizing acids like nitric acid. It resists strong alkaline solutions, and many other, chemical compounds.

PREVENTS CONTAMINA-TION — With stainless there's no pickup of metallic ions or deterioration in the product. Stainless stays out of the process solution.





CLEANS EASILY—Even for the most rigorous cleaning problem—that of decontamination to remove radioactive matter—stainless is chosen decisively over other materials.



WITHSTANDS TEMPERATURE EXTREMES — At very high temperatures, stainless stays strong. At very low ones, it does not become brittle as other metals may.



PROVIDES GREAT STRUCTURAL STRENGTH
—Stainless is about 50% stronger than mild steel. It permits lightweight, durable construction of chemical processing equipment.



RESISTS WEAR AND ABRASION – Erosive and abrading action makes the surface of stainless harder. It's ideal for mixers, chutes, bins and piping.

CHEMICAL ENGINEERING-July 1957



ALLOWS COMPLEX FABRICATION—Stainless can be cut, bent, drawn, welded, machined, forged, spun, riveted, cast—fabricated by all the common metal-working processes. Stainless imposes no restrictions on equipment design.

Crucible metallurgists have had considerable experience with stainless in chemical applications. They will be happy to work with you to make the best, most economical use of stainless in your plant. Crucible Steel Company of America, The Oliver Building, Mellon Square, Pittsburgh 22, Pa.

Send for a copy of the 44page booklet "Making the Most of Stainless Steels in the Chemical Process Industries". It's packed with data you can use.

CRUCIBLE

first name in special purpose steels

Crucible Steel Company of America
Canadian Distributor - Railway & Power Engineering Corp., Utd.



Buflovak's complete machine shop. Modern metal working tools are available for building a wide range of dependable process equipment.

Come to Buflovak with your processing problems

Unraveling knotty processing problems, and building the right equipment to do the job the way you want it done, begins with this simple Buflovak premise: "The most important end product of your process is profit." Our testing, engineering, and production facilities are geared to that result . . . whether the job is big or small.

Here are five ways we can help you solve your processing problems:

- Help you find better processing methods by testing your chemical or food products in our completely equipped Research and Testing Laboratory.
- 2. Build processing or special equipment to your specifications.
- Supply all mechanical design and engineering for building equipment to your basic design.
- Completely design a process and the equipment needed to produce your product so that it will meet your market requirements.
- Supply a standard line of kettles, evaporators, dryers, crystallizers and other equipment to fit your processing.

Why not send us a description of your processing problem, or a blueprint of your design. We will send you our suggestions and an estimate . . . promptly.



A 2000-ton Hydraulic Press forming the

This heavy duty Pinch Roll accurately forms cylindrical shapes from 12 ft. wide up to $2\frac{1}{2}$ " thick.



BLAW-KNOX COMPANY

Buflovak Equipment Division
1551 Fillmore Avenue, Buffalo 11, N.Y.



...and one for the pot!

Witches of old brewed heroic broths to encourage visions, prognostications, spells, and spasms. Even unrequited love yielded to these near-lethal potions. Add the tail of a cat, the ear of a rabbit, sixteen varieties of tree roots, and a few "trigger" ingredients, known only to the witches guild...and stand back!

Folklore ignores the witches' maintenance problems, but such overwhelming corrosives must have liquidated many a cauldron inventory. After all, the witches had no titanium.

Titanium is available today, and it is the most promising metal for the chemical, textile and pulp industries ... or any place where severe corrosion presents forbidding maintenance or design problems.

Titanium is inherently passive to such vicious cor-

roding agents as ferric, cupric, stannic and mercuric chlorides, and the hypochlorites. There is even little or no pitting or localized attack — a source of difficulty with practically all other metals. Stagnant conditions, surface deposits, fouling marine organisms and moist salt crystals are not troublesome to titanium. Strongly oxidizing agents in high concentrations and at high temperatures are readily handled with titanium. Slight additions of oxidizing agents to sulfuric, hydrochloric or phosphoric acid inhibit attack.

Titanium tubing, sheet, strip, plate, extrusions, bar and billet are all available from T.M.C.A.—and prices are dropping to competitive levels. T.M.C.A. technical service is available upon request.

... FIRST IN Titanium



TITANIUM METALS CORPORATION OF AMERICA, 233 Broadway, New York 7, N.Y.

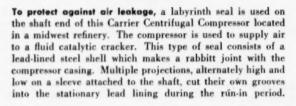


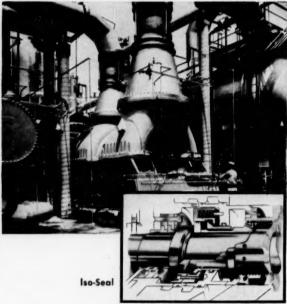
Which is the best way to seal air and gases?



That depends on the type of gas, its pressure, its toxicity and other factors. No matter what the sealing problem, Carrier Centrifugal Compressors are designed with the right seal for the specific job. For example, the labyrinth seal is right for handling air or other non-toxic, non-explosive or inexpensive gases at moderate to low pressures. At the other extreme, an iso-seal is the solution for holding various hydrocarbon gases, especially if the gas must not be contaminated by the sealing fluid or vice versa. For complete information on various compressor seals, call your nearest Carrier office or write Carrier Corporation, Syracuse, New York.







To separate the gas stream from the seal oil system, an iso-seal is used in this Carrier Axial which handles butadiene in a southwest plant. In seals of this type, seal oil, supplied at slightly higher pressure than suction, is kept from gas stream by a floating carbon ring. The seal oil pressure is then broken down to atmosphere through a series of narrow floating babbitt steel rings; the number depending upon the pressure breakdown. On shutdown, this is a positive seal.



If you use stainless or high alloy pipe or tubing, this new illustrated handbook was written for you. It's 58 pages big — packed with informative data that you'll refer to again and again.

The table of contents is too long to list here, but it includes, for example, analysis and conversion tables, corrosion characteristics, weights, alloy properties, bending, joining and installation hints.

We can't guarantee how long the supply will last. To be sure of getting your free copy, why not clip and mail the coupon now?



TRENT TUBE COMPANY

A Subsidiary of Crucible Steel Company of America GENERAL OFFICES: EAST TROY, WISCONSIN MILLS: EAST TROY, WIS.; FULLERTON, CALIF.

Trent Tube Comp East Troy, Wiscon	
Please send me a	capy of your new tubing handbook.
Name	
Address	



Baker Trucks at Humko do double duty!

The Humko Company saves time and cuts costs with a fleet of 5 Baker Fork Trucks. Equipped with truck-loader mast and extra lift attachment, these trucks lift loads 148 inches—high enough for Humko's highest warehouse stacking jobs—from a 68-inch nested mast height—low enough to load highway trucks and boxcars.

Thus Humko takes full advantage of the flexibility of Baker Trucks—using the same trucks for double duty—saving the expense of additional equipment and saving the time of transferring loads from one machine to another... Let us show you how you can make similar savings in your plant or warehouse.

The Baker line includes gas, electric and gas-electric powered fork trucks. Capacities range from 2,000 to 10,000 pounds.

Baker

THE BAKER-RAULANG COMPANY

1210 WEST 80th STREET . CLEVELAND 2, OHIO

industrial trucks

A Subsidiary of Otis Elevator Company





Low-friction bearing seals of TEFLON® unaffected by corrosives in crude oils

Chemical engineers and designers are turning to TEFLON resins for bearings and seals. The Floco Meter is an example of an application in which an article of a TEFLON resin is used for both purposesas a thrust bearing and as a seal. The static friction of TEFLON resins is as low as kinetic friction, permitting immediate starting and greater accuracy. Their antistick properties resist "gumming" of the bearings.

The bearings in the Floco Meter support a rotor, which is the only moving part actuated by the flow of oil. Use of TEFLON resins overcomes the effect of abrasive contaminants in the flowing medium. Foreign particles which penetrate between the bearing surfaces imbed themselves in the resin. Thus, they are rendered harmless and do not score the shaft. The properties of TEFLON 1 (general-purpose molding powder) are suited for seals of this type.

Du Pont TEFLON tetrafluoroethylene resins are unaffected by the chemical ingredients crude oil may contain. This inertness and the thermal stability of TEFLON resins are due to the unusual strength of the carbon-to-fluorine bond. TEFLON resins are also inert to the action of acids, alkalies, aliphatics, aromatics-in fact, to nearly all chemicals and solvents in commercial use. The few exceptions to this include attack by the alkali metals under certain conditions. At high temperatures and pressures, halogens and certain halogenated chemicals and solvents may also affect TEFLON resins.

TEFLON tetrafluoroethylene resins are rated for continuous operation at 500°F. and do not embrittle at temperatures near absolute zero. They have the lowest coefficient of friction of any structural



FLOCO METER shown above is designed to meter crude oil accurately, with a minimum of attention and maintenance. Vital to trouble-free per formance in this pump are bearing seals of TEFLON tetrafluoroethylene resins, which are

material (0.04), and are amazingly tough. Flexible when thin-walled, they are still rigid enough to permit machining to accuracies of half a mil. TEFLON resins also offer unique advantages as an electrical insulator.

Due to these characteristics, TEFLON 1 is an outstanding material for making seals, packings and gaskets. "Self-lubriunaffected by petroleum chemicals and suspended abrasives such as sand. Waxes in the oils do not adhere to the surface of these resins; clogging is prevented. (Manufactured by Flow Equipment Company, Inc., Los Angeles, Calif.)

cated" bearings in chemical pumps and anti-stick facings on hoppers are other typical uses.

Want the specifics on designing with TEFLON tetrafluoroethylene resins? Want to know what other designers have achieved by using these resins? Mail the coupon today.

TEFLON®

is a registered trademark...

TEFLON is the registered trademark of the Du Pont Company. It should not be used as an adjective to describe a product of another concern; nor may this registered trademark be used in whole, or in part, as a trademark for any product.

SEND FOR INFORMATION

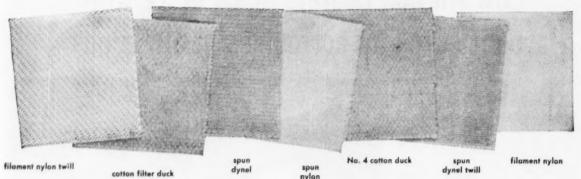
For additional property and application data on Du Pont TEFLON tetrafluoroethylene resins, mail this coupon.

E. I. du Pont de Nemours & Co. (Inc.), Polychemicals Dept. Room 77, Du Pont Building, Wilmington 98, Delaware

Please send me more information on Du Pont TEFLON tetrafluoroethylene resins, I am interested in evaluating this material

In Canada: Du Pent Company of Canada (1956) Limited, P. O. Box 660, Montreel, Quebic

How many of these filter fabrics



can you match up

with these jobs?

1. filtering gluten on iron plate-and-frame presses	?
2. separating dye intermediates from a HCl and H₂SO ₄ solution at 45° C.	?
3. filtering clay slurries	?
4. filtering NaOH at elevated temperatures	?
5. clarifying thick beet sugar juices at 90° to 96° C.	?
6. filtering coal slimes on continuous vacuum filters	?
7. filtering oil and glycerin under 200° F.	?

The typical Wellington Sears filter fabrics shown here were actually assigned the filtration jobs listed above. They were the answers in these particular cases; on other occasions, and under other circumstances, another fabric or another construction might have been specified, according to the needs of the actual problem. Which means a great deal of information must be accumulated and examined -information which you obviously would need in

order to answer our "question" headlined above. But this "impossible" exercise does serve to make one point very strongly: that it takes a filter fabric specialist to establish and evaluate all the requirements of each job, to determine which filter fabric to use. That's why our experience, and the experience of the people who distribute our filter fabrics, can be so helpful to you. Just call. For free copy of "Filter Fabric Facts," address Dept. L-7.

Wellington Sears Wellington Sears Company,

FIRST in Fabrics for Industry 65 Worth Street, New York 13, N. Y.



Offices in: Atlanta · Boston · Chicago · Dallas · Detroit · Los Angeles · Philadelphia · San Francisco · St. Lovis



... or pipe it

ROCKWELL CAN METER IT!

including corrosive liquids

Did you know that your company can save important money by using modern measurement methods in handling industrial liquids? With Rockwell meters you can batch, blend and control formulas with precision. You can guard your costly liquid inventories. You can control costs. And with Rockwell automatic quantity control valves you can save time and money on repetitive operations.

Why not investigate all the advantages of liquid metering in your plant? There's a size and type Rockwell meter for practically every service. Use the coupon or write for a free engineering analysis of your liquid handling operations.



ROCKWELL ROTOCYCLE METER Cutaway to show the all-revolving rotor construction



ROCKWELL Industrial METERS

STAINLESS STEEL . STEEL . IRON . BRONZE

ROCKWELL MANUF. Pittsburgh 8, Pennsyl		COMPANI	Dept (0+ ti
Gentlemens				
I am interested in me	asuring			
		(Name of	Liquid)	
Pipe Size	**			
Working Pressure	psl	Temperature_		_°F ma
Max. Flow Rate	gpm	Min. Flow Rate	•	дрп
Your Name				
Company				
Street				
City		Zone	State	

Here's Why . . .

Silicone Insulation Offers New Economy For Outdoor Motors

Silicone insulation is establishing a trend towards less costly enclosures for outdoor motors. By readily withstanding moisture and contaminants circulated in ambient air, silicone insulation makes possible more open enclosures and lower motor cost per horsepower.

Several leading electrical equipment manufacturers now offer a line of silicone-insulated "all-weather" motors in most large horsepower ratings.

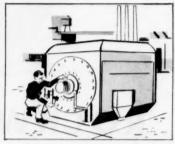
Safe, reliable operation outdoors the year 'round is assured by Dow Corning silicone insulation. Experience has shown silicone-insulated motors readily withstand torrential rains, hurricane winds, corrosive fumes, wind-driven dust, snow, sleet, cold and heat.

Long insulation life is assured by the water-repellent silicone-insulated windings that survive even flooding. Silicone insulation on motors, generators and transformers provides up to 50% greater service factor for absorbing overloads, adds immeasurably to reliable operation and increases insulation life 10 times or more. That's why it's wise to—

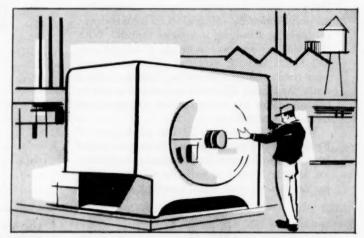
SPECIFY DOW CORNING SILICONES



Initially, motors were sheltered in buildings . . .



Later, motor enclosures themselves sealed out surrounding atmosphere



Now, silicones protect motor parts permitting the circulation of ambient air and lower-cost enclosures.



Dow Corning CORPORATION

MIDLAND, MICHIGAN

Atlanta · Boston · Chicago · Cleveland · Dallas · Detroit · Los Angeles · New York · Washington, D. C.

why you get why you get superior performance from

QCF Lubricated Plug Valves in service LUBRICATED in preserving plant. PLUG VALVES



QCf Valves on varnish tanks of large paint manufacturer.

Study this list of design and operating advantages and you will see why acr Lubricated Plug Valves are meeting the requirements of thousands of plants throughout the nation. acr Valves permit your piping system to handle fluids with maximum efficiency at minimum cost in time, labor and power. Protected seating and sealing surfaces, leak-proof head seal, non-wedging plug reduce "down time" and maintenance to a minimum. For higher efficiency-longer life-lower cost -specify acr Lubricated Plug Valves.

acr Valves are available in semi-steel, carbon steel, bronze and aluminum.

Sizes: 1/2" to 24".

Pressures: semi-steel; 175 lbs. WOG to 500 lbs. WOG.

Carbon steel: ASA 150 and ASA 300,

Representatives in all principal cities.

Ask your Industrial or Mill Supply Distributor for acr Valves.

- Wide Port Maximum Flow Efficiency
- 2. Full Pipe Area
- 3. Patented Head Gasket made of tough self-lubricating Teflon*
- 4. Perfectly lubricated (gun or stick)
- 5. Tight against head leaks under any line pressure
- 6. Minimum number of parts
- 7. Lubricant protects against wear and corrosion
- 8. No exposed seating surfaces
- 9. Quick opening
- 10. Installed in any position
- 11. Compact: fits into small space; gate valve face-to-face dimensions where needed
- 12. Non-wedging cylindrical plug provides easy operation
- 13. Easily dismantled for repairs
- 14. Lubricant release to prevent contamination

*DuPont's tetrafluoroethylene resin.

W-K-M

DIVISION OF C C INDUSTRIES



PLANT: MISSOURI CITY, TEXAS MAILING ADDRESS: P. O. BOX 2117, HOUSTON, TEXAS

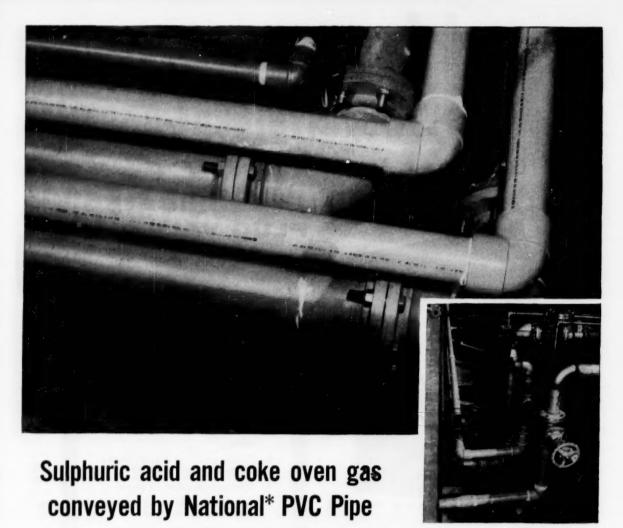
WRITE DEPT. P-7 FOR NEW ACF VALVE CATALOG 400





MANUFACTURERS OF 🖟 W K M GATE VALVES (C) OCT LUBBICATED PLUG VALVES 🖒 KEY-KAST ALLOY STEEL PIPING FITTINGS (N) KEY RETURN BENDS AND FITTINGS





USS NATIONAL Polyvinyl Chloride Pipe is performing two important functions at this steel mill installa-

- It conveys sulphuric acid from acid storage tanks to pickling tanks.
- 2. It carries coke oven gas and combustion air from gas booster pumps and air blowers to submerged burners in the pickling

Polyvinyl Chloride Pipe was chosen for its resistance to internal corrosion from the concentrated sulphuric acid. It conveys acid under gravity flow from elevated storage tanks at ambient temperature, and for its external resistance to 10% to 17% concentrated pickling liquid because the

pipes are exposed to acid spillage as steel is lifted from the pickling tanks.

Approximately 650 lineal feet of NATIONAL PVC Pipe were used in this installation. Sizes were 1½", 3", and 6" diameter—schedule 80, normal impact for sulphuric acid, and high impact for coke oven gas and air. The coke oven gas and combustion air is boosted to 6 to 8 psi at temperatures not over 125°.

NATIONAL PVC Pipe comes in two

NORMAL IMPACT—for installations requiring the highest chemical resistance attainable, together with high strength and excellent creep resistance.

HIGH IMPACT—for installations requiring excellent chemical resistance and a high degree of toughness, even at low temperatures.

Available in sizes from ½" to 6" inclusive, and in Schedules A (High-Impact only), 40, 80, and 120.

For further information, write to National Tube Division, United States Steel Corporation, 525 William Penn Place, Pittsburgh 30, Pa. Specify Bulletin 24.

*Trademark

This seal of the National Sanitation Foundation is carried on all USS National Polyvinyl Chloride Pipe and means—Tested . . . Approved . . . Sanitary!



NATIONAL TUBE DIVISION.

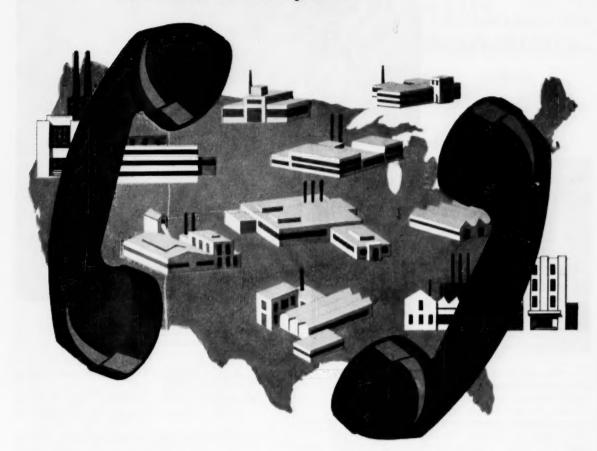
UNITED STATES STEEL CORPORATION, PITTSBURGH. PA.
COLUMBIA-GENEVA STEEL DIVISION,
SAN FRANCISCO, PACIFIC COAST DISTRIBUTORS
UNITED STATES STEEL EXPORT COMPANY, NEW YORK



NATIONAL PVC PIPE

UNITED STATES STEEL

What purity graphite anode will be best for our mercury cells?



Let's call Great Lakes Carbon they've always been helpful, and their product performance is outstanding!



GREAT LAKES CARBON CORPORATION

18 EAST 48TH STREET, NEW YORK 17, N.Y. · OFFICES IN PRINCIPAL CITIES

Speedline Fittings Cut Process Piping Costs

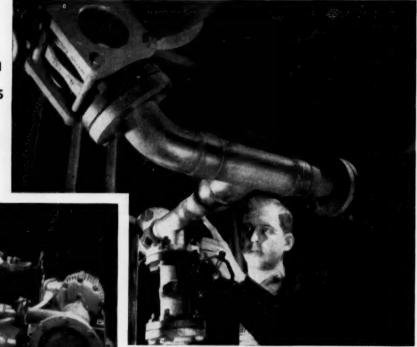
DESIGN FEATURES

ALSO SOLVE CORROSION

AND LEAKAGE PROBLEMS

at

CHAPMAN CHEMICAL COMPANY



Process lines at Chapman Chemical Company, Memphis, Tennessee, manufacturers of wood preservatives, agricultural and industrial chemicals.

"Easiest, most economical means to assemble leakproof, stainless steel process lines", says D. B. Smith, chief engineer at Chapman Chemical Company. Thanks to the "tangential" feature of Speedline fittings—which permitted on-the-job selection of joints with or without welding—labor time and costs were cut to a minimum. Corrosion and leakage problems common to conventional fittings were also eliminated on stainless steel reactor lines used in the manufacture of ester resins. Speedline features offered other important advantages throughout the installation.

- System provided positive corrosion and heat resistance to handle low concentration of sulphuric acid... other solutions at temperatures up to 500° F!
- Simplified construction of multi-purpose system manifold, because exclusive "tangential" feature—an extra straight section on every end

of every Speedline fitting—permitted flanging without welding!

- Aligning connectors speeded installation and insured leak-proof joints, where welding was required.
- System allows for easy modification of existing lines to meet future process piping requirements.

Only Speedline corrosion-resistant fittings, designed especially for use with economical, light wall Schedules 5 and 10 stainless pipe, provide these time and cost saving advantages not possible with conventional fittings.

How the design features of Speedline fittings can help solve your process piping problems is described in a

fully illustrated data book available on request. Write today for a copy of Speedline Catalog at no obligation . . . or contact the Speedline distributor nearest you.





STAINLESS STEEL FITTINGS
THE NEWEST THING IN PIPELINE ECONOMY

SPEEDLINE DISTRIBUTORS ARE LOCATED IN PRINCIPAL CITIES FROM COAST TO COAST

Manufactured by HORACE T. POTTS COMPANY • 500 E. Erie Avenue • Philadelphia 34, Penna.

NEW POWERSTAT® Variable Transformer

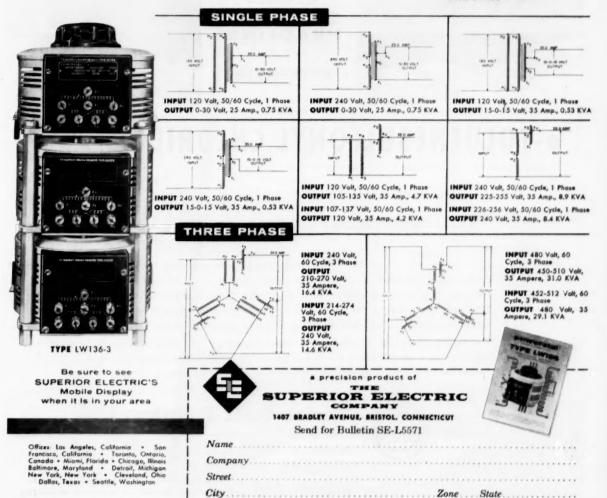
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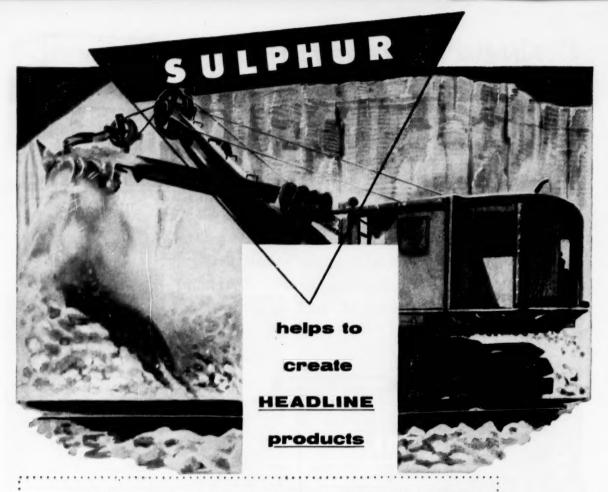
New Flexibility with Isolated Secondary Winding on Single Core

> ... a source of adjustable low voltage output ... a limited range line correction ... a limited range of "buck boost" voltage

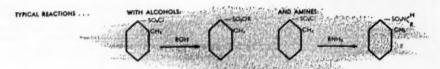


TYPE LW136





o-TOLUENESULFONYL CHLORIDE*



Industry has a new working tool in O-Toluenesulfonyl

Chloride. This 98% pure ortho isomer can be used in building molecules for use in a wide variety of new products, from dyestuffs to pharmaceuticals; from plasticizers to herbicides. It is even possible that it is now being used in products you are making or have recently acquired.

From the chemical name of o-Toluenesulfonyl Chloride it is obvious that sulphur is a component of this compound...added evidence of the important role Sulphur plays in our industrial economy.

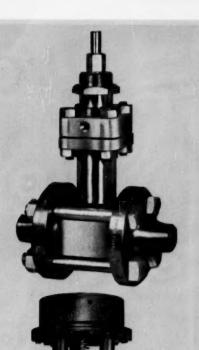
*Product of Monsanto Chemical Company



Texas Gulf Sulphur Co.

75 East 45th Street, New York 17, N.Y. 811 Rusk Avenue, Houston 2, Texas

- Sulphur Producing Units
- Newgulf, Texas
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- . Spindletop, Texas
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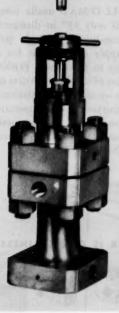


PACKLESS VALVES YOU CONNECT AND FORGET

Some valves are good for severe corrosives, others for high pressures and temperatures, but these Fulton Sylphon Packless Valves are complete valves capable of mastering the toughest possible combination of conditions in atomic energy plants and grueling chemical processes. They assure utmost safety in handling hazardous materials, require no periodic maintenance, and practically eliminate down-time.

Typical of how Fulton Sylphon matches valve to process, these valves are made of stainless steel throughout, with the valve body machined as one unit from solid bar stock. And to prevent leakage or contamination, a SPECIAL SYLPHON® BELLOWS in multi-ply stainless steel forms a permanent, leak-proof seal for the stem. That is why they tame the severest corrosives inside and out. This is the reason, too, why these valves provide a high safety factor in high temperature-high pressure service.

These and other Fulton Sylphon Valves are available in many types, sizes, and metals—all with packless construction for greater safety, less maintenance and longer runs "on stream."





SEND TODAY FOR

A SPECIAL SYLPHON BELLOWS which forms the permanent, leak-proof stem seed on all fulton Sylphon Packless Valves offers four outstanding features. It is (1) coldworked for greater resiliency and longer life, (2) seamless, without welded seams to break and leak, (3) formed in multi-plies for greater strength, and (4) made in the right metal for service requirements.





Robertshaw-Fulton

CONTROLS COMPANY

FULTON SYLPHON DIVISION . Knoxville 1, Tennessee

Dust, Dirt—and
Maintenance
HEADACHES
Removed by
Roll-o-MATIC





AAF AIR FILTER REQUIRES ONLY ONCE-A-YEAR SERVICING

THE filter curtains of this two-section ROLL-O-MATIC were once as white as the paper held in the man's hand. Now, note the gradation of color from light gray to black on the curtains' surface. When the accumulated dust load increases operating resistance to a predetermined level, ROLL-O-MATIC takes matters into its own hands—introduces automatically just the right amount of clean media from the rolls at top, while the dust laden media is rerolled at the bottom.

No one has to guess when or how much clean media is needed. No bells clang or red lights flash to summon a maintenance crew. The ROLL-O- MATIC "just keeps rolling along" cleaning the air and itself automatically.

A 65 ft. length of ROLL-O-MAT media compresses into a compact roll only 13" in diameter. Under normal operating conditions, a single roll represents a full year's supply of clean air for a ROLL-O-MATIC section up to 11 ft. high (18000 cfm). Its cost—just half that of disposable filters of equal capacity. Its savings—countless maintenance man-hours plus the "worrying time" of management.

For complete information on this proven renewable media air filter, call your local AAF representative or write for ROLL-O-MATIC Bulletin 248.





Herman Nelson Unit Heaters



Herman Nelson Portable Heaters



Leave processing problems behind when you use ESCAMBIA PVC 1200 in your calendering operation. This new low molecular weight resin gives you better control over color drift, has lower reject rate from "fish-eyes' and important other advantages for your product.

- Outstanding Heat Stability
- · Very Low "Fish-Eye" count
- Free-Flowing Hot Pre-Mixes
- Uniform Particle Size
- Excellent Color and Clarity

These advantages are also found in other Escambia resins in this new series:

- ESCAMBIA PVC 1250—One trial with this resin in dry blend extrusion will convince you that it has no equal.
- ESCAMBIA PVC 1225 Intermediate in molecular weight, between PVC 1200 and PVC 1250, this resin has outstanding qualities never before available in a single resin.

For additional information about Escambia's New Resins-write or call:



ESCAMBIA CHEMICAL

261 MADISON AVENUE

NEW YORK 16, N. Y.

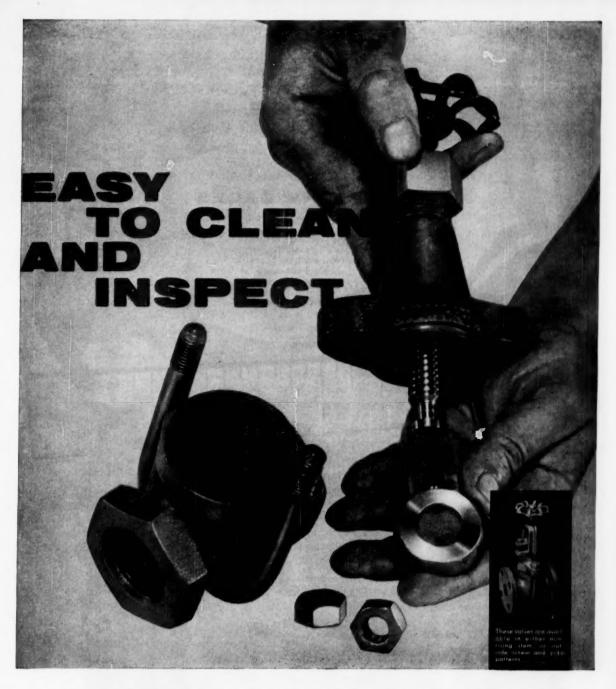
We four INTERESTED IN AGITATION In Laboratory-Scale High Pressure Reactions?

 Be sure to read this article in the April, 1957 issue of Industrial & Engineering Chemistry . . .
 or let us send you a reprint.





Autoclave Engineers
2932 WEST 22nd STREET . ERIE, PENNSYLVANIA



Wolworth iron body suddle type wedge gate valves are suitable for use on steam, water, gas, gasoline, oil, and many process lines. They are easy to take apart, simple to service, fast to reassemble. Walworth saddle-type valves are available in a wide range of sizes in eleven different combinations of design and materials including bronzemounted, all-iron, and ni-resist; with both flanged and screwed ends. All types can be repacked under pressure when fully opened or fully closed.

Ask your local Walworth distributor to give you complete information or, write for circular.

WALWORTH

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DISTRIBUTORS IN PRINCIPAL CENTERS THROUGHOUT THE WORLD

WALWORTH SUBSIDIARIES: ALLOY STEEL PRODUCTS CO. . CONOFLOW CORPORATION . GROVE VALVE AND REGULATOR CO. SOUTHWEST FABRICATING & WELDING CO., INC. . MEH VALVE & FITTINGS CO. . WALWORTH COMPANY OF CANADA, LTD.



CUSTOM DESIGNED FILTRATION

Get the last ounce of efficiency, at no extra cost ...it adds up to big savings

When your filter runs hour after hour...month after month...

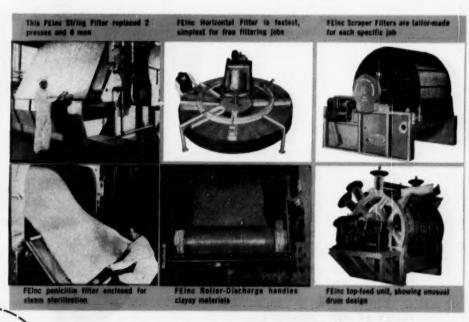
a few points extra efficiency soon pays back the cost of the finest machine you can buy.

There's only one sure way to get this last ounce of efficiency:

custom design. In all types of rotary vacuum filters, FEinc's custom design has

consistently delivered whatever is required. Whether you want
higher recovery of valuable solubles with less dilution...lower impurities in

finished cake...2-6% less moisture... or just higher output
in limited floor space... FEinc can deliver. We'll be happy to conduct complete
tests and submit recommendations. No obligation. Write today.



FEINC FOR A BIGGER

FILTRATION ENGINEERS, INC.

SUBSIDIARY OF AMERICAN MACHINE & METALS, INC. 155 Oraton Street, Newark 4, N. J.

Custom designed continuous filtration



in making an almost indestructible turbine

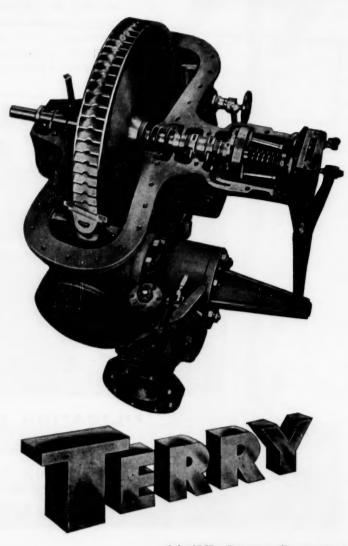
The rotor of a Terry solid-wheel turbine is a single forging of special composition steel. It is first rough turned in two operations, as shown, and then two cuts are taken to mill the semi-circular buckets from the solid metal. The wheel at the top has been finished, ready for mounting on the shaft. The result is a single-piece wheel with no parts to loosen or wear out.

Blade wear, which might occur after many years of usage, is not important, because the power-producing action of the steam takes place on the curved surfaces at the backs of the buckets. Thus wear does not materially affect horsepower or efficiency.

The blades can't foul. They have a one-inch clearance, and are further protected by the projecting rims at the sides of the wheel.

1 e Terry solid-wheel turbine is an extremely reliable piece of equipment. Write for details today. Ask for a copy of bulletin S-116.

TERRY STEAM TURBINE CO.
TERRY SQUARE, HARTFORD 1, CONN.





between the
devil and
the deep—
on CORROSION?

call on

C-N ZIRCONIUM TECHNICAL SERVICE

Corrosion Resistance of Zirconium

ın	Cel	rtain	media

Excellent in 10% to 50% NaOH from

Excellent in 5% NaOH @ 212°F. Poor in 40% NaOH @ 230°F.

Hydrochloric acid

iodium ydroxide

Excellent in dilute HCl at all temps. In conc. HCl: Excellent at room temp. Poor at boiling pt

Excellent in dilute and conc. HCI from room temp. to 212°F.

Potassium hydroxide Excellent in 10% to 40% KOH from room temp. to

Excellent in 5% KOH @ 212°F. Poor in 40% KOH

Excellent: Less than 0.005 in, penetration per year Poor: More than 0.010 in, penetration per year Data from "Zirconium, its Production and Proper ties" Bulletin 561. Bureau of Mines.

A new economical solution to many problems of corrosion is in the making — Columbia-National ZIRCONIUM. For example, unique zirconium properties include exceptional resistance to strong, hot alkalies and acids.

Large quantities of commercial-grade zirconium sponge are now available from Columbia-National's plant near Pensacola, Florida. Zirconium milli shapes are available from leading producers of alloy products.

Don't get stuck between the "devil and the deep"!

Columbia-National's engineering staff and research laboratories, with extensive experience in all aspects of metallurgy, will be your extra brain-power for investigating zirconium in relation to your specific problem — providing actual data for applying to your product or process. Write for data on properties, fabrication and corrosion resistance of zirconium.

Columbia-National Corporation

Jointly owned by Columbia-Southern Chemical Corp. and National Research Corporation

DEPT. C-2D - 70 MEMORIAL DRIVE, CAMBRIDGE 42, MASSACHUSETTS



™ Specialty Safety Products

A Necessity in Every Plant

AO 750 LENS CLEANING STATION

Selected hardwood, safety green, smoothly lacquered finish. Small, compact with provision for all necessary cleansing and anti-fog materials. Attaches to wall at strategic plant locations. 12" long, 9" high, 6" deep.

When ordered complete:

- · Consists of 6 oz. bottle 750B and Sprayer 750S. By pressing plunger, fluid is sprayed on lenses. Order fluid separately.
- 2 boxes of 750T cleaning tissues each containing 120 sheets. 2 openings in front of cabinet make it easy to detach single sheets.
- · 2 compartments at top provide for disposal, keep
- Anti-Fog: One 1 oz. jar supplied. Superior AO 350AF SUPER-CLEAR available on separate order.





Very Efficient! Easy to Use!

AO 350AF SUPER-CLEAR

Combination Lens Cleaner and Anti-Fog

Independent tests show SUPER-CLEAR keeps plastic and glass surfaces fog-free longer than any solution tested! Cleans and de-fogs in a jiffy — just spray it on and wipe it off! Non-toxic, non-inflammable, will not deteriorate metal or rubber. Use full strength without distribution. Available in 2 of scores. out dilution. Available in 2 oz. squeeze bottle, pint bottles and 1 gal. containers — packed ten 2 oz. bottles per carton. There is nothing comparable.

AO 372-8 Straightaway



SOUND PROTECTOR

For Extreme Noise Levels

Advanced design elongated type covers jawbone opening; superior against both high and low frequency noises. Neoprene covered spring headband is dielectric and assures even pressure. Vinyl sponge ear seals conform to contour of temples on glasses. Unit fits any head shape. Up and down adjustment allows proper positioning and vinyl foam ear filter puffs can be removed for easy sterilization. Entire unit can be sterilized by immersion in a solution of AO#101 Germicidal Detergent. Rustproof - for use indoors and out.

AO 109B SWEATBAND

Protection, Efficiency for Pennies!

A true safety device — keeps fo cool and reduces eye injuries by - keeps forehead preventing perspiration from carrying foreign particles into eyes. Absorbs 20 times its weight in perspiration. 13/4" wide. For 1" width, order 108B.



Always insist on Trademarked Safety Products. Your nearest American Optical Safety Products Representative can supply you.

American D Optical SAFETY PRODUCTS DIVISION

SOUTHBRIDGE, MASS BRANCHES IN PRINCIPAL CITIES

SCRUBOSPHERE ...



- The dust removal ability of the SCRUBOSPHERE is superior because it utilizes wetted surfaces for dust collection which are much more closely spaced than in conventional equipment.
- Oil loss is minimized because the oil used to wet the dust collecting surface is lifted mechanically instead of bubbling gas through the oil which results in foaming and loss due to creation of hard-toseparate fine particles.
- Maximum performance and low cost The spherical design means high capacity and performance because it provides maximum dimensions for the contactor and mist extractor which normally are limiting factors in scrubber designs. The vessel cost is reduced because required vessel thickness is only one half that required for cylindrical vessel of same diameter.
- Versatility separates solid and liquid particles with equal efficiency.
- Low pressure drop ½ to ¾ psi at rated capacity depending on nozzle size.



PEERLESS MANUFACTURING CO.

P.O. BOX 13165

DALLAS, TEXAS

Representatives in All Principal Cities

Write for test data showing dust removal and oil loss of Peerless Scrubosphere as against conventional dust scrubber.

PERMUTIT® presents the

VALVELESS FILTER

Completely Automatic Gravity Filter Costs Less than Manual Unit

Uses no valves, no pumps, no flow controllers

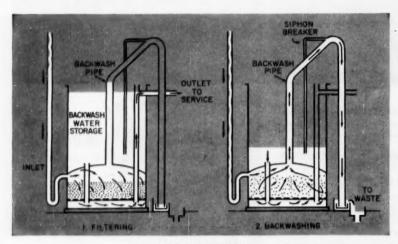
Here's an entirely new concept in water filters for cities, factories and power stations: a filter that *eliminates* operation and maintenance expense... yet costs *less* than a conventional manually-operated gravity filter of the same size.

The Permutit Valveless Filter can be used wherever gravity flow is feasible. Units are now in operation providing both plant process and drinking water.

FOOLPROOF OPERATION

The Valveless Filter thinks for itself. It starts backwashing at a predeter-

mined head loss, rinses and returns to service automatically . . . and as efficiently as an expertly operated manual filter. It assures uniform, high quality effluent because it eliminates "human error." It cannot be forced. It cannot backwash or rinse too soon or too late, too fast or too slow, too much or too little. It cannot develop a negative head and thus eliminates the chief cause of mudballs, channelling, upset beds. The absence of gravel eliminates another cause of upset beds. Backwash or rinse water cannot be accidentally run to service.



HOW IT WORKS

Filtering. Water enters at left, flows through sand, strainers and false bottom up effluent duct to service. As head loss increases during run, water rises in backwash pipe. At maximum headloss, water spills into downward section of backwash pipe and starts backwash (siphon) action.

Backwashing. Siphon draws water from storage down through ducts, up through strainers and sand to expand and wash bed, then to waste. At low storage level, air enters siphon breaker to stop backwash. Flow reverses and filtered (rinse) water flows into storage until full. All flow then goes to service.



PROVEN PERFORMANCE

Photo shows two Valveless Filters in a large industrial plant. (Shut-off valve at left is used only to take front filter out of service.)

LOW INSTALLATION AND EXPANSION COST

Filters up to 10 ft. diameter are shipped set up. Piping is simple. Future filters are easy to add since they require no additional backwash water storage or pump capacity. Filters use minimum floor space.

FREE BULLETIN

New bulletin, "The Permutit Valveless Filter," includes details, drawings, operating conditions, capacities. Address: The Permutit Company, Dept. CE-7, 330 West 42nd St., New York 36, N. Y. or Permutit Company of Canada Ltd., Toronto 1, Ont.

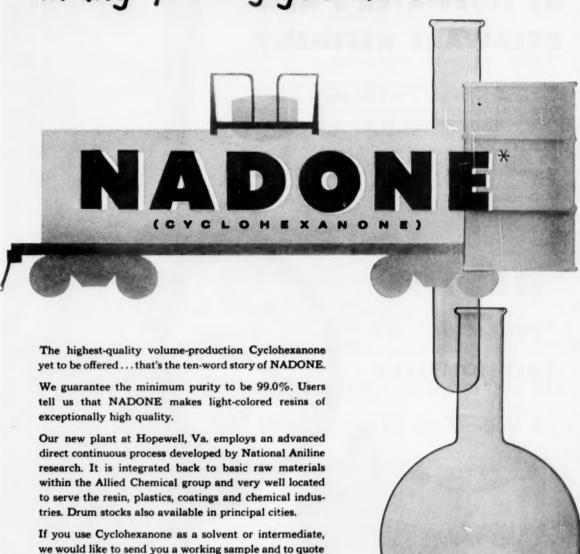
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on your needs. We'll also be glad to send our 24-page Technical Bulletin I-19 giving properties, reactions and

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a very extensive bibliography.

THERMOMETRY

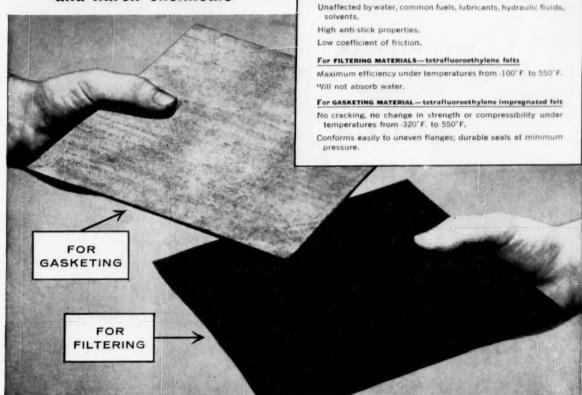
AT TIDEWATER'S NEW DELAWARE REFINERY

Large plant or small, thermometer specifications invariably are based on past performance... the ability of the thermometer to stay on the line — give years of accurate, trouble-free service —effect savings in overall costs. On this basis WESTON bimetal thermometers invariably get the nod. For years their exclusive multi-helix sensing element has proved far superior in accuracy, repeatability, and stability. They provide all the dependability essential in modern processing. Available in types, sizes and ranges for most industrial needs. For all the facts write — Weston Electrical Instrument Corporation, 614 Frelinghuysen Avenue, Newark 12, N. J.





Remarkable resistance to heat and harsh chemicals



New ARMALON® felts show exceptional service life in strong corrosives, temperatures up to 550° F.

Corrosion-resistant filters and gaskets of new "Armalon"* tetrafluoroethylene resin assure extraordinary long life felts where other materials fail entirely. They've proved their superiority in systems handling strong acids and bases—at temperatures from -320°F, to 550°F.

"Armalon" is the new felted form of Du Pont's "Teflon"** tetrafluoroethylene resin, available in two constructions —one for filtering, the other impregnated for gasketing." "Armalon" is inert to water, common fuels, lubricants, hydraulic fluids, solvents and corrosive chemicals.

FILTERS of "Armalon" remove fine particles at high flow rates with minimum pressure drop. Anti-stick property of "Armalon" means longer service life, easier cleaning.

 $\textbf{GASKETS} \, of ``Armalon'' seal securely and$

last months, even years, longer than other materials. Advantages include substantial reductions in costly replacement shutdowns.

PROPERTIES OF "ARMALON" FELTS
GENERAL

Highly resistant to strong acids and bases at all temperatures.

For more facts that may help you find a place for "Armalon" felts in your operations, fill out and mail the coupon. You'll receive Du Pont's free descriptive bulletin, including specifications.

*''Armalon'' is Du Pont's registered trademark for its tetrafluoroethylene felta and impregnated felts.
*''Teflon'' is Du Pont's registered trademark for its tetrafluoroethylene fiber.
†''Armalon'' tetrafluoroethylene impregnated felt is covered by U. S. Patent 2,764,666.

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Please send me descriptive bulletin on "Armalon" felts.

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Clarity of a liquor means many different things. In the food field, for example, it spells customer acceptance (which is why so many food processors use Dicalite Filteraids). To the chemical engineer, the brilliant clarity obtained with high-efficiency Dicalite Filteraids represents the essential first step along a quicker, easier course to desired quality in the end product.

Even the most difficult liquors can be filtered to required clarity with Dicalite Filteraids... and filtered at economically fast flowrates. There are 8 Dicalite Filteraids, differing principally in particle size and range, to handle the removal of unwanted particulates, even those in the colloidal, bacterial and sub-micron range.

Being practically pure silica, Dicalite Filteraids are inert in acid and aqueous solutions and are both physically and chemically stable. They do not support bacterial life, and are sterilized in processing. Consistent uniformity is another important Dicalite characteristic, obtained by a most rigid system of quality control over each step as filteraids are processed from highest-grade diatomite.

A Dicalite service engineer will be glad to advise with you on the application of Dicalite Filteraids, or you may obtain information by writing.

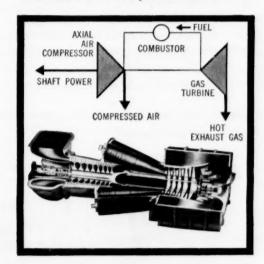


Dicalite Division, Great Lakes Carbon Corp., 612 S. Flower St., Los Angeles 17, Calif.

Shaft power,
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all from one
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By taking advantage of the versatile Westinghouse gas turbine, engineers are simplifying many processes. For example . . .

As gasifiers—In a large Southwestern butadiene plant, four Westinghouse gas turbines will soon be operating as gasifiers for the reactivation of the catalyst and each will elimi-





nate the need for a separate prime mover and a separate air compressor.

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Versatility—The modern Westinghouse gas turbine can be used to streamline processes, for it offers many combinations of output:

Shaft power.....up to 22,500 hp Compressed air....up to 85 psia Hot gas (18% oxygen)....up to 1000°F

Ask today for your set of suggested process sketches. Contact your Westinghouse representative, or write to Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pa. J-50598

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Still another research tool from Lithium Corporation...

LITHIUM METAL

(LOW SODIUM CONTENT)

The latest from L.C.A.

Following on the heels of the discovery that lithium metal dispersions make unique polymerization catalysts (isoprene polymerized to a synthetic rubber which closely resembles natural rubber) comes recent interest in organolithium compounds as reagents for commerical uses. The preparation of these compounds often requires metallic lithium as the source of the lithium atom. This suggests that a lithium metal of low sodium

content (0.005% maximum) may be advantageous, research-wise, in developing laboratory experimentations into possible commercial processes. Atomic energy holds still further possibilities.

This refined grade of lithium metal, as well as the commercial grade, is available in experimental and commercial quantities in the following physical forms: ingot, cup, rod, wire, ribbon, shot and dispersions in suitable media.

Got a catalyst problem? Investigate the practicability of lithium metal. Your request on company or institutional stationery will receive prompt attention.

... trends ahead in industrial applications for lithium



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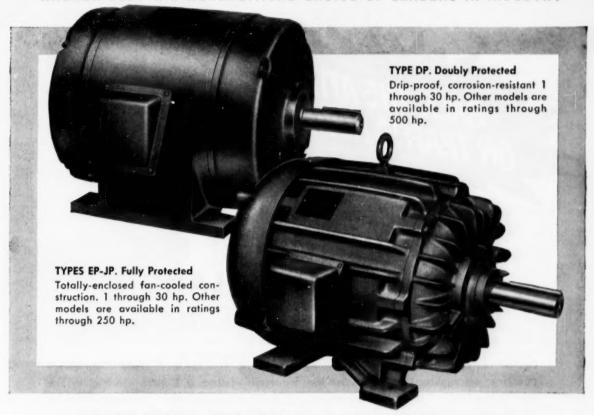
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PRODUCTION GOES UP when you power equipment

with these Wagner Motors

Production is increased when motor down-time is reduced. To meet today's industrial demands for faster, more dependable production, Wagner has designed these industrial motors with extra protection that cuts

These motors pack more power in less space—1 through 30 horsepower in NEMA frame sizes 182 through 326 U.

time-out for motor maintenance to a minimum.

EXTRA PROTECTION—Type DP is doubly protected by a rugged corrosion-resistant cast iron frame and by completely drip-proof enclosures.

Types EP and JP are totally enclosed against dust, grit, fumes or moisture—protected against corrosion by cast iron frames. Type JP is explosion proof as well.

COOL RUNNING—Both types are cool running. Blowers and special baffles direct cooling air through the DP motor. Types EP and JP are fan-cooled and are built with ribbed frames to increase the cooling surface.

LONGER BEARING LIFE—Original bearing lubrication will last for years in service under normal conditions, but openings are provided in the bearing housing to add fresh grease—remove old grease when required.

Let a Wagner motor application engineer show you how well these motors can fit *your* needs. Call the nearest of our 32 branch offices, or write us. Bulletins MU-202 and MU-203 give complete information on these Wagner Motors. Write for your file copies today.



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These companies have been helping to sustain an advertising campaign that performs a desperately-needed public service: It shows the American people how to drive to stay alive. It also portrays the almost unbelievable fact that more than 40,000 men, women and children were killed in traffic accidents last year—and tells what to do to help stop highway homicide.

The campaign was prepared by a volunteer advertising agency in cooperation with The Advertising Council and The National Safety Council. But the over ten million dollars worth of time and space which carry the messages to the public was contributed by media owners or sponsored by business organizations, in the public interest.

Your own plans may readily permit the inclusion of such advertising—both from the view of the vital public service it would perform, and the incalculable good will it would promote for your name, your company, and your product or service,

To find out how easily your own program can tie in with this nationwide effort, and for the complete story on who, what, when and where, we sincerely invite you to write to The National Safety Council, Chicago 11, Illinois.





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Other Chemicals



Chemicals for a growth area

Pulp, petroleum, and plywood are three of the main reasons why industry is popping in western Canada.

Fitting neatly into this growth picture is the new plant of Hooker Chemicals, Ltd., in North Vancouver, B.C. The plant, which opens this summer, is Canada's first chlor-alkali producing point west of the Rockies.

By rail and barge, it will supply caustic soda and chlorine for making and bleaching pulp; more caustic soda to help sweeten petroleum refinery products and to produce plywood adbesives.

Hooker customers around Vancouver will enjoy a freight saving on these chemicals, which formerly came into the area by sea-going barge from our Tacoma plant.

Is your supplier growing with you?

In its modest way, this new Hooker plant underscores a point that you may consider important in your own expansion plans.

You have much to gain by tying up with a chemical supplier geared to the spread of industry into new areas; accustomed to anticipating your requirements of tomorrow, even while serving you dependably today.

Close to the major industrial centers of the East, Midwest, and West Coast, Hooker plants and stock points give you quick, dependable service when you need it. All Hooker caustic soda plants and distributing points are on deep water. This makes transportation extremely flexible. It tends to minimize shipping costs, and permits a choice

that can make a big difference if an emergency occurs.

And if you buy l[c]l, there's an authorized Hooker distributor nearby, ready to meet your needs for caustic soda and other Hooker chemicals.

If you'd like to see how this flexible, fast-moving supply team can strengthen your position on chemicals, drop us a line and we'll get the facts to you promptly.

New bulletin lists Hooker products

You'll find a complete up-to-the-minute listing of Hooker chemicals in this new 12-page bulletin.

The new bulletin supersedes General Products List 100 and Bulletin 100-A which you may have now. Indexed for ready reference, it lists the chemicals you can buy from us in commercial quantity, including chemicals sold under the NIALK® and OLDBURY® brand names.



Under each product you'll find a short description and condensed listing of properties, actual and suggested uses, and shipping containers. The bulletin also sums up for you the major types of processing performed at Hooker.

If you'd like to have this up-to-date timesaver in your file or on your desk, just check the coupon for a copy of Bulletin 100-A.

Here's data on phosphorussulfur compounds

Every time you strike a match, you're helping to justify the market researchers' predictions for one of our OLDBURY Products: red phosphorus.

This fascinating element got off to a commercial start in this country in 1910, on the site of the present OLDBURY Products plant in Niagara Falls.

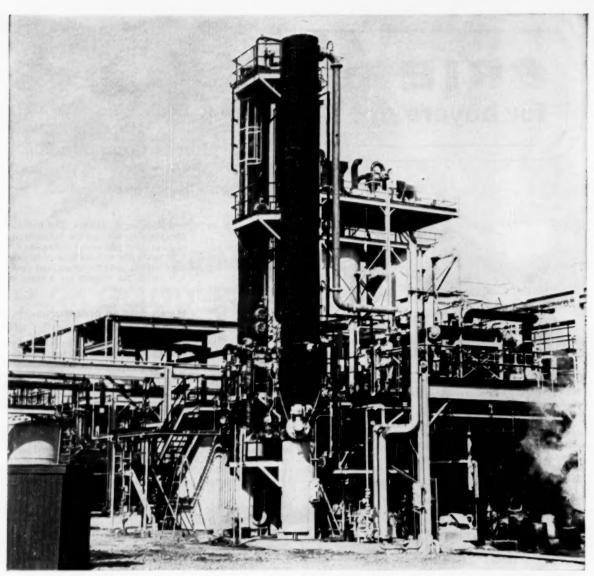
Today many other items that must burn up before they can do anyone any good are made with Oldbury red phosphorus or phosphorus sesquisulfide, P₄S₃. These include matches, fireworks, safety and signal flares, fusees, and smoke screens.

Your product may require another equally useful, though less dramatic, way of putting phosphorus to work:

Phosphorus Pentasulfide, P₄S₁₀. We make it in three particle-size grades of powder, and as a fused solid. Phosphorus content is 27.8% minimum. Powder forms come in lever-pak drums, 150 lbs. net; solid in single-trip steel drums, 215 lbs. net.

These products are available, as always, under the highly reputed OLD-BURY label. For more information, we suggest you check the coupon for new technical data sheets just completed.

Caustic Soda	☐ Phosphorus, red
New list of products—Bulletin 100-A	☐ Phosphorus Pentasulfide
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Key to Tomorrow's Problems

ON EQUIPMENT AND PRODUCTS IS YOURS FOR THE ASKING

COMPLETE PRODUCT INDEX of chemicals, materials, equipment and services taken from this issue's advertisements and new products departments. You can get more information on any item by circling its code number on one of your Reader Service postcards.

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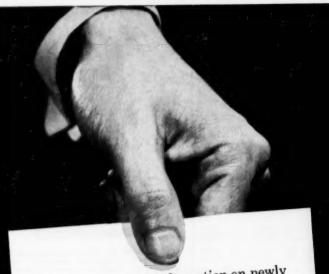
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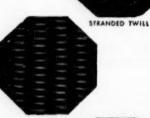
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- Adhesives.....Industrial materials selection chart lists application and descriptive information including data on adhesives coating and sealers. Six sections cover reclaim rubber, synthetic rubber, latices, others. 396C Miracle Adhesive Corp.
- Adhesives Adhesives, protective coatings and sealers are described in a 4 p. folder, Bulletin 650A. Recommended use, method of application and properties of eight typical products are tabulated.

 396D Raybestos-Manhattan, Inc.
- Antioxidant.....16 p. brochure, called
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 *Becco Chemical Div.
- Chemicals, Rare.....Catalog lists hundreds of rare organic and inorganic chemicals and rare metals for use in research and production. Includes latest chemicals for electronics research in transistors, etc.

 3961 Kern Laboratory Supply Co.
- Chemicals. Stabilizing.....Bulletin FL.
 1-42 covers new chemical compounds developed for dimensionally stabilizing paper and cellulose. They are said to produce permanently flat photoprints.
 396J Upsom Chemical Corp.
- Cuprous Chloride.....Technical Bulletin 100 describes Bower Brand pure cuprous chloride. Gives formula, specifications, safety precautions, appearance, uses and physical and chemical properties. 396K Henry Bower Chem. Mfg. Co.
- Elastomers......Maintenance paints based on Hypalon resist ozone, oxidising chemicals, heat and weather, come in stable colors. Peoprene hose recovers original properties. Elastomers Notebook. 169 *E. I. du Pont de Nemours.
- From advertisement this issue

- Epoxy Hardener.....Technical bulletin 13, 2 p., describes good heat distortion temperature, toughness and flexibility of resins cured with agent that combines with liquid epoxies at room temperature. 396L Smooth-On Mfg. Co.
- Epoxy Resins.....28 p. booklet discusses epoxy resin compounds designed for the electrical and electronics industry. Peatures tabulations of physical and electrical properties for nine potting resins.

 396M Epoxylite Corp.
- Epoxy Resins.....New bulletin covers new solventless single component epoxy resin compound having exceptionally high heat distortion. It was developed for use on rotating field coils. 396N Sterling Varnish Co.
- Esters, Methyl..... These methyl esters are readily available from the El Dorado Div.—capyrlate, Eldo 18, caprate, laurate, coconate, myristate, caproate, palmitate. Details available and samples offered.

 391b *Foremost Food & Chem.
- Flocculant, Selective A selective flocculant for ore refiners is said to precipitate dissimilar particles suspended in aqueous mixtures when only 0.002% by weight is added. TD 1248.

 71-2m

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- Glue....New fortifier for conventional urea resin liquid wood glue is described in Bulletin TD-45. Product is particularly suited to "moderate" exterior applications such as protected doors.

 3660 Borden Co.
- Gum Arabic.....Laboratory reports
 A-820-G2 and A-820-G3 contains
 data on the preparation of clear
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 Arabic. Of interest to users of the
 product as emulsifier, coating.
 396P Morningstar, Nicol, Inc.
- Intermediate.....For Acrolein dimer (2-forml-3, 4-dihydro-2H-pyran), physical properties, shipping data, chemical properties, reactions and physiological properties are discussed in 8 p. bulletin F-8516A.

 396Q Union Carbide Chemicals Co.

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71-21 *U. S. I. Chemicals Co.

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179 *Solvay Process Div.

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397A Atlas Powder Co.

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397B Alpha Molykote Corp.

ticides Technical bulletin 47.
"Formulator's Manual for Liquid
Fertilizer-Liquid Pesticide Mixtures," tells how to use new emulsifler for field mixing of pesticides
with liquid fertilizers.
397C Emulsol Chemical Corp. Pesticides .

Plasticizers.....Two 4 p. bulletins de-scribe new esters useful as plasti-cizers and in the formulation of synthetic lubricants. They are di-2ethylhexyl isosebacate and di-nyl isosebacate.

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Radioisotopes Specifications and prices for a line of radioactive isotopes for industrial, medical, research and educational uses are search and educational uses are given in Technical Bulletin 14A. Covers half life, beta energy, etc. 397G Nucleonic Corp. of Amer.

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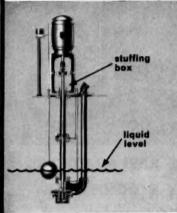
305 *American Cyanimid Co.

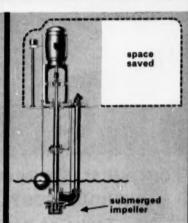
Sodium Ferrocyanide.....Sodium fer-rocyanide (yellow prussiate of soda) is used as a raw material for Iron Blue pigments, as a stabilizer and accelerator in electroplating baths, etc. Bulletin 200. 397H Henry Bower Chem. Mfg. Co.

· From advertisement this issue

you stop leakage, save space, and cut costs with Yeomans

VERTICAL WET PIT PUMPS

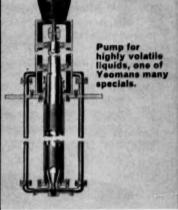




ELIMINATE LEAKAGE. Stuffing boxes and seals are not under liquid pressure. With the Yeomans Vertical Wet Pit Pump there are no costly, annoying, or dangerous liquid leaks, as with horizontal pumps.

SAVE FLOOR SPACE. They use less than half the space required by horizontal pumps. Also, no priming equipment is needed as with suction lift horizontals. Impellers are submerged in the liquid ready for service.





CUT MAINTENANCE COSTS. With exclusive Lubri-vac® bearings are kept free of abrasive matter. Lubricant pressure prevents fluids from working into bearings. Result: Bearing failures are 90% less than with conventional vertical wet pit pumps.

SPECIAL DESIGNS. 59 Years of experience has enabled Yeomans to develop many excellent special designs for pumping "problem materials." All pumps can be furnished with ferrous and nonferrous alloy parts as required. Capacity range from 5 to 10,000 g.p.m.



YEOMANS

Manufacturers of: pumps for drainage e sewage e condensation return e water supply and circulation e equipment for treatment of domestic and industrial wastes.

Yeomans, 2004-1 N. Ruby Street, Melrose Park, Illinois

Please send me the catalog on Yeomans Heavy-Duty Vertical Wet Pit Pumps for...

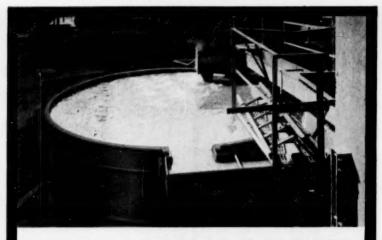
solids-free liquids

solids-bearing liquids

name		

company_ street.

state_ city_ zone__



CHEMICAL STORAGE AND HANDLING WITHOUT COSTLY CORROSION! Tanks of Beetle Bonate®

Now, you can store and process corrosive chemicals, without the old corrosion maintenance problems, with tanks fabricated by Beetle of Beetle Bonate plastic. The 7,000 galion "Bonate" tank above has handled selenious acid at 160°F since 1954 without showing a trace of corrosion. The tank shown below has been storing 23% sulphuric acid for over three years at a large western copper refinery and has been maintenance free.

Tanks, covers and hoods of any size can be made of Beetle Bonate in one piece or in sections for easy installation in confined, cramped areas. Light-weight, nonconductive and temperature resistant, Beetle Bonate storage tanks and processing equipment deserves your immediate attention. For full information, write now.



145 GLOBE STREET, FALL RIVER, MASS.



Solute, Cleaning A spray-on cleaning "solute" is offered as compatible with water of 0-50 grain hardness, fast-acting, simple to rinse off, harmless to steel, paint and personnel. TD 1242.

71-2g °U. S. I. Chem. Co.

Solvents.....16 p. booklet describes properties and applications of fluorinated hydrocarbon solvents in industrial cleaning jobs ranging from immersion of electric motors to general maintenance. 398A Du Pont Co.

Stearic Acids "Emersol Stearic Acids" is the title of a 24 p. booklet designed to aid selection of proper grade for each end use. It interprets the results of analytical tests commonly performed on the acids.

398B Emery Industries, Inc.

Sulfur.....Comprehensive 48 p. brochure, "Stauffer Sulfurs," describes production and refining techniques statistics on world production, notes on the various uses of the material. Tabulations of properties. 398C Stauffer Chemical Co.

Surfactants.....2 p. data sheets are available on each of four products composing company's new "J" series of nonionic surface active agents. All members are good wetters, detergents, dispersants. 398D Olin Mathieson Chem. Corp.

Tall Oil.....4 p. leaflet on tall oil gives application information, average characteristics, specifications such as acid, saponification and iodine numbers, color, rosin acids, fatty acids for four grades.

398E Welch, Holme & Clark Co.

Tributlyltin Oxide A tributyltin oxide to control microbiological slime in pulp and paper mill systems is reported highly successful under all pH conditions. Noncorrosive, economical. TD 1241.

71-2f *U. S. I. Chemicals Co.

Construction Materials

Alloys.....Process equipment protected with Hastelloy Alloy C can be used to handle acids, fats, oils, or other corrosive materials. If you have a severe corrosive condition, send for Booklet.

293 *Haynes Stellite Co.

Aluminum....Process Industry applications of aluminum for producing everything from beer to bomb shells are analyzed in 80 p. book, "Process Industries Applications of Alcoa Aluminum."

24-5 *Aluminum Co. of America.

Asbestos.... Selecting asbestos for any application or temperature range is now simplified by 16 p. reference manual. Covers cloth, tape, tubing, lap, roving, cord, wick and rope, each shown with uses and photos. 398F Union Asbestos Co.

Ceramics. Chemical Chemical ceramics will resist all acids, alkalies and all solvents (except hydrofluoric acid and hot caustics). White chemical porcelain is especially good. Bul. C-5.

138

*U. S. Stoneware Co.

[•] From advertisement this issue

Grating and Treads.....In Bulletin 2527 you will find descriptions and illustrations on electroforged, riv-eted, rectangular, diagonal, "U" type and "T" interlocked gratings and treads and treads.

Blaw-Knox Co.

Coatings, Plastic Data Sheet "Plasticap B" describes tough, flexible thermo-setting plastic coating for corrosion-resistant tubular goods. Resistant to shock, abrasion, mechanical damage. mechanical damage.
399A Plastic Applicators Inc.

Coatings, Protective Amercoat 33HB, a true high build vinyl coat-ing, resists corrosive chemicals, severe weathering and abrasion at the lowest cost of any leading vinyl. Data and figures.

*Amercoat Corp.

Coatings & Linings.....Bulletin VP-2
describes Unichrome Plastisols,
which produce thick, corrosion-resistant vinyl coatings. Bulletin
Chem-C-2 describes phenolic coatings for tank linings.
64 *Metal & Thermit Corp.

Coatings

tings & Linings "Plasticap Corrosion Resistant Coating, Rub-bercap Protective Rubber Lining" bulletin describes protection against various kinds of corrosion, abrasion, *Plastic Applicators Inc.

Fabrication, Plate Plate fabrication and erection of vessels, tanks, tion and erection of vessels, tanks, towers, odd and intricately designed chemical equipment . . . to any size . . . of any material. Complete details in Cataiog 54B.

104 *Hammond Iron Works.

s, "Armaion" "Armaion" is the new felted form of Du Pont's "Tef-lon" tetrafluoroethylene resin, avail-able in two constructions, one for Felts, "Armaion" Descriptive Bulletin.

379 *E. I. du Pont de Nemours & Co.

PRECIOUS

Hard Carbide Metals.....Company of-fers booklets B-111-A, "Characteris-tics of Kennametal" and B-222 "Designing with Kennametal." Wide range of hard carbide com-positions resist corrosion, impact, *Kennametal Inc.

alation Types, characteristics and applications for Class A shel-lac- and varnish-coated papers. varnished fabrics, slot cell insula-tion are discussed in new 8 D. Bulletin B-7206. 399C Westinghouse Electric Co. Insulation

Insulation, Electrical.....24 p. booklet discusses use of epoxy resins for protecting all forms of large electrical apparatus. Cost comparison data plus case histories show product's economy.

Fronylite Corp. Epoxylite Corp.

Insulation, Foamglas.....Foamglas is immune to moisture, acid atmospheres, spillage, condensation damage and other hazards of insulating outdoor equipment. Foamglas industrial Insulation Booklet.

96 *Pittsburgh Corning Corp.

Insulation, Pipe Complete specifi-cations for a silt, one-piece sec-tional type molded mineral wood pipe insulation that snaps into place are presented in a new 4 p. bulletin. Request your copy.

399E Baldwin-Hill Co.

* From advertisement this issue

Wire Clor

in Rolls or **Cut Pieces**







WIRE CLOTH all standard grades, for Industrial and Paper Mill use, all weaves, widths to 244", corrosion-resistant alloys.

FILTER CLOTH all standard weaves and densities, woven in corrosion resistant alloys, extra wide. NEVA-CLOG perforated metal sheet filter medium-strong, rigid, smooth, non-clogging. MYKRO-PORE electrodeposited metallic filtering or straining medium with retention to 20 microns. MICRO-MESH high shute count filter cloth up to 1500 wires/in.-retention to 10 microns.

in Fabricated Components

"RIM-LOK" leaves for stationary leaf batch pressure filters, vertical or horizontal shell. Filter leaves (bare or covered) for all other standard pressure filters. Custom-made leaves and elements to your special design. Screens—Strainers—Cylinders—Vibrating Screens

Discs-Process Equipment or components-Trays

Inquiries invited. Write for Catalog

MULTI-METAL WIRE CLOTH CO., INC. 1353 GARRISON AVENUE NEW YORK SO N

BISHOP Ru METAL CATALYST

RECOVERY UNEXCELLED



Backed by a century of successful precious metals refining and fabricating BISHOP methods assure you the most accurate Precious Metal recovery possible.

Modern refining techniques and accurate assaying and process control enable BISHOP to recover 100% of the Precious Metal values in your spent catalysts.

So, for the highest return on your recovery dollar consult BISHOP experts. Depend on BISHOP skills.

MANUFACTURERS OF

Fails Electrodes Clad Metals Composite Wires Laboratory Apparatus Precious Metal Salts and Solutions

Stainless Steel, Nickel and Nickel Alloy Tubing

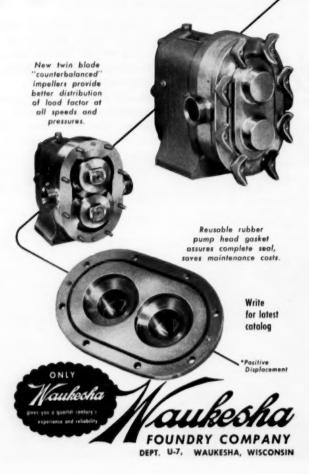


J. BISHOP & CO. PLATINUM WORKS

Department CR Malvern, Pennsylvania

New Twin O-Rings in the WAUKESHA Corrosion-Resistant Pump provide a positive product seal without using troublesome packing glands. These are available in Buno-N (neoprene) for normal conditions, or in Kel-F where excessive corrosion or high temperatures are met. Newly developed also is a re-usable gasket in the pump head which eliminates the uncertainty and expense of paper gaskets. Greatly improved service life and remarkably low maintenance keynote the new WAUKESHA Pump. And the principle of positive displacement provides a smooth, virtually non-pulsating flow without aeration, cavitation or product damage against pressures up to 150 PSI and vacuums up to 29 inches of mercury.

No matter what may be your pumping or corrosion problems WAUKESHA provides a pump to meet the most difficult conditions.



- Insulation, Pipe & Block.....New 6page bulletin "New Ehret Thermasil" gives you details on new line of calcium silicate insulations for temperatures up to 1,200 F. Physical property tables. 400A Ehret Magnesia Mfg. Co.
- Insulation, Plastic..... Bulletin 1200-2, 1 p., illustrates polyvinyl jacketed thermocouple extension wire. Describes the advantages and features of the insulation. Gives specifications and ordering data.

 400C Claud S. Gordon Co.
- Insulations, Industrial.....No matter where your insulation job may be —Armstrong can give you efficient, well-integrated service from original specs to final installations. Booklets describe full line.

 111 *Armstrong Cork Co.
- Laminates, Low Pressure Bulletin covers low pressure laminates for corrosion resistance, electrical insulation, high strength and unlimited shapes. Company offers further information.

 400B Carl N. Beetle Plastics.
- Linings & Tile Tanks.....Stebbins installations can be made under a contract which covers everything, from the original design to the finished job ready for use, including maintenance. Bul. A-156.

 308 *Stebbins Eng. & Mfg. Co.
- Plastics, Polyvinyl Chloride. Bulletin 80-3 tells all about this amazingly versatile material and its applications, Ryertex-Omicron PVC resists attack of more than 250 corrosive solutions and gases.

 269 *Joseph T. Ryerson & Son.
- Steel, Stainless Technical data sheet covers a special stainless steel used for jet engine parts, high pressure steam valves. Covers physical and mechanical properties, resistance to corrosion.

 400D Allegheny Ludlum Corp.
- Steels, Clad.....One side corrosion resistant nickel or high alloy; the other rugged, economical carbon or alloy steel. Permanent bond produced by heat and pressure on rolling mills. "Clad Steel Equipment."

 90

 *Lukens Steel Co.
- Steels, Stainless.....Company offers informative 44 p. booklet, "Making the most of Stainless Steels in the Chemical Processing Industries." Dozens of Crucible stainless grades are available to you.

 349 *Crucible Steel Co. of America.
- Tantalum.....Company offers a corrosion test kit, available without charge to research technicians. Contains tantalum sheet. Also publication, "Corrosionomics," containing articles on tantalum.

 408 *Fansteel Metallurgical Corp.
- Varnish, Insulating.....Bulletin discusses Alliseal modified alkydsilicone heat reactive insulating varnish L.A. V6450—tank life and shelf life, thermal endurance, mechanical strength, etc.

 400E Louis Allis Co.

July 1957—CHEMICAL ENGINEERING

[•] From advertisement this issue

Varnish, Phenolic Bulletin dis-cusses asphalt phenolic varnish— LA V6150—which has been devel-oped for insulating electric motors, generators, solenoids, transformer, etc. Presents advantages. Louis Allis Co.

Electrical & Mechanical

Batteries, Industrial. Revised, com-plete reference catalog on motive-power batteries discusses important new features of Exide-Ironciad bat-teries for industrial trucks and mine vehicles. Electric Storage Battery Co.

Bearings, Non-Lubricated.....Carbon graphite non-lubricated bearings described in new 16-page catalog operate under very high temperatures, are chemically inert, overcome many maintenance ills.

401C Electro-Nite Carbon Co.

Casters & Wheels.....New 56-page catalog 125 contains illustrations, descriptions and specification data on hundreds of types and sizes of casters for every industrial requiree-Hamilton Caster & Mfg. Co.

Casters & Wheels.....Featuring Dar-nelloprene treads (a soft resilient Neoprene rubber compound)... casters offer ease of movement, quietness and protection for floors. Details available in Manual. L422 Darnell Corp.

Circuit Breakers.....New "FB" current limiting circuit breakers protect against fault currents of 1000 to 150,000 amperes. Small in size. quick in action. Available in several models. Bulletin 3004-A.

60 *I-T-E Circuit Breaker Co.

Diode.....2 p. data sheet covers new temperature limited diode type de-signed for service as a RMS detector for differential voltmeters, for a-c voltage and current stabilizers and similar uses. 401E Superior Electric Co

Drive System..... Modification of the Varidyne system, covered in Specifi-cation Sheet Sec. 400, p. 29, and Bulletin F-1910, permits soft starts, inching and jogging of a remote variable-speed motor. 401F U. S. Electrical Motors.

Drives, Shaft Mounted Falk Shaft Mounted furnish the economical solution to problems of efficient speed reduction in a limited space. Company makes details available to you in Bulletin 7101.

*Falk Corp.

Gasket Cutter..... Bulletin 140 de-scribes Garlock's latest gasket cut-ter. Versatile tool cuts round gaskets from asbestos, rubber, cork or fiber sheets. Known as the "B" set, it's fine tool.

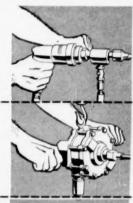
Generators, Steam Pre-engineered, standardized steam generators offered in 9 sizes, with capacities of from 50,000 to 150,000 lb. per hr. Includes drawings & design features. Bulletin B-55-4.

161 *Foster Wheeler Co. Garlock Packing Co.

ELLIOTT SMALL TUBE CLEANERS types to do all jobs quickly and effectively

ELLIOTT 600 SERIES for small tubes-straight or curved

These air- or steam-driven motors are excellent for routing light scale in tubes with inside diameters from 5/8" to 13/4" Various types of cutter heads and brushes are available for specific tube cleaning requirements.



ELLIOTT 5100 SERIES lightweight cleaner for removing medium scale

Air-driven motor with trigger action for motor control, finger-action valve for water flow, built-in speed governor and oil reservoir. Two sizes

ELLIOTT SUSPENSION SERIES for heavily scaled straight tubes

Air, steam, or electric motor drives shaft fitted with drill or brush head. Motor is suspended outside, shaft and head enter tube.



ELLIOTT JIFFY GUN for extra-fast cleaning of light accumulations

Simply insert nozzle into tube and push. Released air or water pressure shoots nylon brushes or rubber plugs through condenser or heat exchanger tubes. For tubes 1/2" to 1"

For details on Elliott tube cleaning and maintenance equipment, contact Elliott District Office or write Elliott Company. Lagonda Division, Springfield, Ohio.

LIOTT Company Headquarters for Tube Cleaners and Expanders

STEAM TURBINES . MOTORS . GENERATORS . DEAERATING HEATERS . EJECTORS . CON DENSERS . CENTRIFUGAL COMPRESSORS . TURBOCHARGERS . TUBE CLEANERS . STRAINERS

[·] From advertisement this issue

DENVER PROCESS EQUIPMENT

DENVER
(patented)
SUPER
AGITATORS
and MIXERS



3'× 3'

20'x 20

Patented standpipe around propeller shaft assures positive agitation and circulation. Patentad wearing plate prevents sand-up on shut-down. Heavy duty as well as acid-proof construction is available in both opentupe, air lift and Super Agitator models. Please write for Bulletin No. A2-84.

DENVER Steel-Head BALL MILL



3'x 2' to 6'x 20' A Denver Steel-Head Ball Mill will suit your particular need. Five types of discharge tyunions. All-steel construction. Lew initial cost due to quantity production. Quick delivery. Laboratory and pilot plant mills also available. Please write for Bulletin No. 92-813.

DENVER Forced-Feed JAW CRUSHER



21/4"x 31/2" to 36"x 48" Cast Steel Frame, manganese jaw and cheek plates. Large diameter shafts reduce shaft deflection and thus increase life of heavyduty, oversize roller bearings in bumper. Setting easily controlled. Please write far Bulletin No. C12-B12.

DENVER Disc FILTER



Tank Agitator can be supplied

to

Special, patented design of segments in Denver Disc Filters use both gravity and vacuum to give a drier filter cake. Drainage is complete and positive, with no blow-back. Simple, low-cost, dependable construction. Quick delivery. Also Drum and Pag Filters. Please write for Bulletin Mo. FG-81.

DENVER
"Sub-A"
FLOTATION



Laboratory and Commercial Flotation is the selective separation of particles from each other in a liquid pulp by means of air bubbles. Mure large plants are installing Denver "Sub-A's" for their entire flotation jab, because they give maximum recovery at a law cost per ton. Dependable, low-cost, simplified continuous operation. Please write for Bulletin No. F10-881.

DENVER Rubber Lined PUMPS



Up to 2400 G.P.M. Denver (Soft Rubber Lined) Sand Pumps lower pumping costs 30% to 70% due to simple design, lighter weight and accuracy of rubber peris which increase efficiency 11/2 to 3 times over other sond pumps. Have molded rubber impellers and casing liners for long life. Write for Bulletin No. PP.68.

DENVER Automatic SAMPLERS



6" to 68" Cutter Heavy duty units, entra rigid track and ballbearing wheels assure positive travel and timing of sample cutter. Available in stainless steel for acid anl corrosive service. Wet and dry cutters. Central Control Panel for multiple samplers. Bulletin No. 51-84.

DENVER-DILLON Vibrating SCREENS



1'x 3' ' to 6'x 14' Gives fast, clean separation without blinding. Gives even, smooth flaw of material because of the patented "true-circle" eccentric action. Two-bearing construction saves 50% HP. Please write for Bulletin No. \$3-811.

DENVER Spiral Rake THICKENER



3'x 3' to 80'x 12' Enclosed, running-in-oil heed motion. Patented spiral rakes move settled solids to center discharge with continuous motion, rapid removal of solids tends to eliminate overload. Wood, Steel or Rubber-lined Tanks available. Write for Bulletin No. 15-85.

DENVER
Batch and
Continuous
TESTING

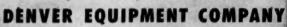


Laboratory and Pilot

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Use Denver Testing Laboratory facilities for complete batch or pilot tests—your engineers or ours. Ample test facilities for investigations on crushing, grinding, mixing, classification, separation, sampling, leaching, concentration, thickening, filtration and drying. Consultation is without obligation. Please write for Bulletin No. T4-B15.

One source... one responsibility



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LITERATURE . . .

Generators, Steam ... Vogt steam generators are available in bent tube types and straight tube forged sectional header types for solid, liquid or gaseous fuels. Product bulletins available upon request.

271 *Henry Vogt Mach. Co.

Motors....Bulletins 51X8581 and 51X8582 translate to bulletin form the
messages on motor maintenance
told by two A-C colored sound slide
films, "How to Make a Motor Go
and Go." "How to Take Step Seven."
402A Allis-Chalmers Mfg. Co.

Motors.....8 p. folder describes a new electric motor, called Actionator unit, for the operation of rotary, slip-stem and butterfly valves, dampers and other final elements in automatic control systems. 402B Minneapolis-Honeywell Co.

Package Drive.....How the Ultra-Speed package drives makes possible increased flexibility of machines and equipment is told in new bulletin 51B8166A. Unit is d.c. conversion device, 5 to 200 hp. 402C Allis-Chalmers Mfg. Co.

Packings, Teflon.....Long Life Chempro Teflon Packings last for many months under corrosive conditions that destroy conventional packings in days or hours. Truly tight seal. Bulletin CP 552. L426 *Chemical & Power Products.

Power Supplies..... Magnetically regulated power supplies are described in a new 4 p. catalog. Covers filament power supplies, telemetering and strain gage power supplies, computer power supplies.

402D Gulton Industries.

Power Unit..... A power unit that provides variable-frequency current to vary the speed of 3-phase a.c. induction motor is covered in Specification Sheet Sec. 400, p. 17 and Bulletin F-1910.

402E U. S. Electrical Motors, Inc.

Regulators. Voltage.....1 p. illustrated data sheet SE-L2578 covers company's Stabiline automatic voltage regulator type TM7101 designed for applications where little or no attention is possible.

402F Superior Electric Co.

Relay. Motor-Protecting.....A device that protects any 3-phase, induction motor against failure is described in leaflet "Type TS Motor Protecting Relay." Units are custom-made for given motor. 402G Electrical Service Co.

Relays.....8 p. illustrated booklet gives complete information about a new line of interchangeable multiple pole and fixed multiple pole relays. Diagrams, dimensional drawings. Send for a copy. 402H Arrow-Hart & Hegeman Co.

Rings & Stems.....Modern, troublefree OIC end-seated seat rings and T-head stems at no extra cost will reduce your maintenance overhead many times. Streamlined flowthrough. Iron Valve Bul. 1005. 89 *Ohio Injector Co.

Starters, Motor.... Complete line of synchronous motor starters for all low voltages and for 2200-4800 volt power systems. Complete protection, easily installed. Ask for Bulletins 8200 and 8820. 121 *Electric Controller & Mfg. Co.

• From advertisement this issue

- Tools. .. Company offers free, complete catalog of industrial wrenches and hand tools, including ratchet wrenches and Torqo-meters. Com-pany also advises on special tool problems. *Snap-On Tools Corp.
- Transformers, Variable New Powerstat variable transformer has new flexibility with isolated secondary winding on single core, a source of adjustable low voltage output. Bulletin SE-L5571.

*Superior Electric Co.

Turbines.....Both regular type wheel or wide bucket "L" type wheel give you Coppus proven high quality and low maintenance cost. "L" type wheel is for use where water rate is essential. Bul. 135.

*Coppus Engineering Corp.

Turbines, Steam....."Advances in the Field of Large Steam Turbines" tells about new developments in today's steam turbines and how they are the design forerunners of the future. Reprint of speech.
403A Allis-Chalmers Mfg. Co.

Turbines, Steam.....Terry solid-wheel steam turbines are almost inde-structible, with their single-piece wheel, unfoulable blades, negligible blade wear. Request your copy of Bulletin S.116 Bulletin S-116.
372 *Terry Steam Turbine Co.

Handling & Packaging

- is, Conveyor New conveyor belt engineered for small diameter pul-leys is described in a new bulletin. Belt is said to combine the flexi-bility of solid woven belting with properties of stitched canvas. 403B Russel Mfg. Co. Belts, Conveyor
- riers.....Carriers are permanently sealed, pre-lubricated, economical to install and maintain, have quick-change roller. Also, complete line of bulk material handling products. Catalogs 355 & 60. 58 "Stephens-Adamson Mfg. Co. Carriers.
- Conduits, Aluminum.....Company of-fers literature and one-foot sample of Alcoa Aluminum Electrical Rigid Conduit, which weighs % less than steel, is safer, easier to bend and thread. No straining.

 *Aluminum Co. of America.
- Containers, Glass, Plastic Comprehensive listing of glass and plastic containers and closures is contained in new 103 p. catalog. Listings made according to size with drawings, specifications. 403C W. Braun Co.

Conveyors.....Ajax Lo-Veyors are compact, self-contained units that compact, self-contained units that can be suspended from ceilings, along walls, under or at floor levels, giving maximum flow capacity in limited space. Bul. 39. T425 *Ajax Flexible Coupling Co.

Geor

B. M Alld

Conveyors, Screw — Components.....

Related ball bearing equipment (trough ends, hangers, etc.) that has been added to company's screw conveyor component line is described in 6 p. Folder 2489.

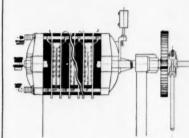
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Link-Belt Co.

THE SPERRY LTER PRES

IS THE MOST POPULAR AND MOST PROFITABLE METHOD OF FILTRATION

Superior Performance - The Sperry Filter Press can thoroughly wash the cake while it's still in the filter press chamber . . . deliver the filtrate to a higher level than the filter . . . filter emulsions . . . deliver the driest cake . . . and produce an outstanding product of uniform purity and stability.



Versatility-Sperry Filter Presses are made in a variety of models and capacities . . . for use with any type of filter media or filter aid . . . to handle the widest range of filterable mixtures, including viscous materials . . . under a wide range of operating pressures and controlled temperatures.

Economy-Sperry Filter Presses are low in first cost . . . low in upkeep . . . low in installation costs . . . low in operating costs . . . low in depreciation . . . and long in life.

Sperry engineers are always available to put all the advantages of the Sperry Filter Press to work for you. Write today for an analysis of your particular filtration problems, or ask for your free copy of the SPERRY FILTRATION CATALOG, containing specifications and other technical data for your reference.

D.	R.	SPERRY	&	CO.,	BATAVIA,	ILLINOIS
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Filter Plate Pro	Pilter Bases
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redge & McCabe 847 E. 17th Ave. Denver, Colorado	Company
s Chemical Eng. Co. 4101 San Jacinto, Houston, Texas	Address
i	CityState

[·] From advertisement this issue



Dolly.....Catalog sheet tells how the Multiton Jr. provides an inexpensive way to handle loads ranging from 1,000 to 6,000 lb. close to ground level. Dolly moves on three rollers. Send for a copy.
404A Co.

Idlers, Belt Conveyor....New 8-page bulletin describes complete line of belt conveyor idlers including flat, troughing, self-aligning, rubber disk and return designs. Lists std. sizes, dimensions, weights, etc. 404B C. O. Bartlett & Snow Co.

Pulleys, Magnetic....Dings permanent magnetic pulleys, made of highest grade Alnico, are designed with extremely high surface strength for protection against tramp iron damage. Bulletin C-1007A. 395 *Dings Magnetic Separator Co.

Rack, Pallet.....1 p. flyer pictures and describes a new adjustable rack for pallet, skid and bulk storage. Rack is designed for easy adjustability of shelf height to accommodate changing space requirements.

404C M-H Standard Corp.

Scales....New Toledo Weight Fact Kit will help you determine how well your scales measure up as a weighing system and help you detect weighing inefficiencies that drain profits. Send for it now. 217 Toledo Scale Co.

Scales..... Howe Scale Catalog No. 11
Is a handy reference featuring the popular scales from the complete line of standard Howe scales. Includes specifications and spot illustrations.

403D Howe Scale Co.

Scales, Electronic Seven new bulletins about Fairbanks-Morse electronic weighing and batching machinery are just off the press. Write company today for free copies of one or more.

290 *Fairbanks & Morse Co.

Scales, Railroad track.....You get all modern "plus" features in Howe four-section straight lever railroad track scale—lever system, main bearings, checking, live and dead rails, etc. Form 685. 403E Howe Scale Co.

Seals, Mechanical....."John Crane"
Seals, specially engineered for the
Chemical Industry, eliminate loss of
expensive and corrosive fluids. Company gives information in seal catalog.

*Crane Packing Co.

Tanks.....Cherry-Burrell stainless steel tanks store, mix, heat and cool a variety of products. Vertical or horizontal models, with many accessories, including thermostats, lamps.

Bulletin G-506X.

336 *Cherry-Burrell Corp.

Tanks, Chemical Storage.....Company supplies tanks and vessels for chemical storage, made of carbon and stainless steel, aluminum and special alloys. 103 years of experience. Get "Tank Talks." T416 *R. D. Cole Mfg. Co.

Tractor. Industrial 2 p. leaflet describes new industrial tractor designed for towing of interplant trailer trains and for gathering warehouse orders. Includes photographs, specifications, dimensional drawings.

404F Hyster Co.





ACETATE DOPE, to be exact. This is the material—with a viscosity at O.T. of 450,000 CP, operating temperature 140°F.—that is being satisfactorily handled by these five

WARREN

#31/4 External Gear and Bearing Screw Pumps

together with seven more, all built for the Rome plant of Celanese Corporation of America

a leading producer of chemical fibers.

These pumps are of special design, with straight-through oversize connections on body; complete with flexible coupling, base, jack shaft, pillow blocks, sprockets, chain guard, and motor with sliding base. Built for variable pressures from 20 to 300 PSIG.

If you have difficult-to-handle liquids, unusual conditions or requirements, Warren Engineering and Warren Pumps pay off.



ck, Pallet.....Recent changes and improvements made in a 1-ton capacity hydraulic hand pallet truck are illustrated and discussed in new bulletin 226. Sketches and photos of applications Truck, Pallet ... photos of applications.

Raymond Corp.

Trucks, Automatic Pick-Up.....4 p. folder A-304-F-2 describes a new truck-mounted detachable container unit with fork-like arms. It enables containers to be picked up and set down automatically. 405B Dempster Bros., Inc.

Trucks, Fork.... Allis-Chalmers 1012 trucks are safe, easy to maneuver, durable, versatile. They have torque converter drive to stop clutch trouble, rigid channel, pressure-lubricated hearings. Cat. cated bearings. Cat.
20 *Allis-Chalmers Co.

cks, Gas.....Sturdy Yale Gas Trucks have self-adjusting hydrau-Trucks, lic brakes, high-speed power lift, low cowl for better visibility, capacities 2000 to 20,000 lbs. Request Booklet 510ID. 225 *Yale & Towne Mfg. Co.

Trucks, Platform.....2 p. leaflet describes a platform truck designed to transport loads of up to 4.000 lb. safely and rapidly through confined aisles and crowded areas of terminals and warehouses.

405C Hyster Co.

Heating & Cooling

Boiler-Burner Units.....In Bulletin 900 you'll find the line of Interna-tional oiler-burner units which offer the superior performance fea-tures of water-tube boilers plus the advantages of burner selection. International Boiler Works.

lers.....New 8-page brochure AD-162 describes in detail complete line of model CB boilers. Points covered— —unusual fuel flexibility, four-pass forced-draft design, unified electric and steam preheater Cleaver-Brooks Co

Fans, Corrosion-Resistant.....How a new line of resin-bonded fiber glass fans handles a wide variety of cor-rosive applications up to 225 F. is described in manufacturer's new bulletin FI-511. Buffalo Forge Co.

Heat Exchangers..... "Flexible-stand-ard" units are adaptable to vertical, inclined, or horizontal installation.

Offer many features you look for in custom-built heat exchangers. Request copy of Bulletin 837.

4th Cover *Pfaudler Co.

Heat Exchangers.....The Alcotwin heat exchanger furnishes real economy in the first cost, in ease of the latter and maintenance. Unomy in the list cost, in case of installation and maintenance. Unlimited adaptability prevents obsolescence. Details available in lescence. De Bulletin FH-3. *Alco Products.

Heat Transfer, Pilot Plant Unit.....
Girdler's line of Votator heat transfer units for laboratory or pilot plant work. High rate of heat transfer, pressures to 500 psi. Free Bulletin V217.

*Girdler Co.

· From advertisement this issue

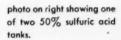


CONSTRUCTION gives you

the plus beyond the price



photo on left showing two large phosphoric acid tanks.





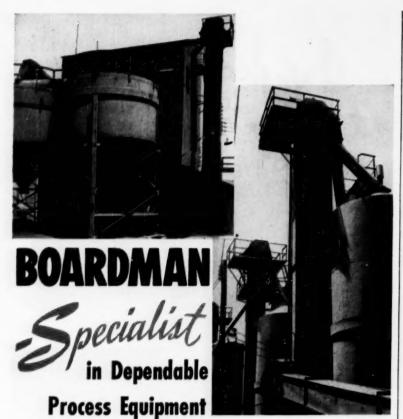
The above photographs picture a recent Atlas installation at the U.S. Industrial Chemicals Co., Div. of National Distillers Products Corp., at Tuscola, Illinois. This type of construction is typical of the "Plant-Wide" corrosion protection service that Atlas offers to the Chemical Industry.

The above installation consisted of two tanks for 50% hot sulfuric acid and two tanks for phosphoric acid. All work was done by Atlas crews at the job site.

Yes, there is a big plus beyond the price when you specify Atlas, only then will you get a completely integrated construction service, one that will accept full and sole responsibility for your job and will 'guarantee every aspect of it. This unique service is available to your industry, anywhere in the world, for new plant construction, expansion or maintenance work. Whatever the requirements, Atlas can and will do it right and on time.

Avail yourself of the complete facts today. Write for Bulletin CC-3.





American Zinc Company of Illinois put BOARDMAN engineers to work designing and fabricating special smelter equipment. These BOARDMAN-manufactured ore conveyors, elevators, storage bins and slag separation bins are on the job at American's Machovec Smelter, Dumas, Texas.



- Heaters, Thermal Liquid Company's thermal liquid heaters offer advantages: accurate temperature control; high heat transfer rates; low cost, low pressure operation; heat on demand. Bulletin TLH. 393 *International Boiler Works.
- Heating Units, Immersion.....'Surface' immersion heating, with diffusion combustion and the heating tube completely immersed in the liquid put the heat where you want it. Gas firing. Bulletin SC-156.

 431 *Surface Combustion Corp.
- Ovens.....Aminco forced-convection ovens eliminate hot and cold pockets, provide temperature control, minimize power consumption. Motor-driven blower for uniform distribution. Bul. 34-37-C. 311 *American Instrument Co.
- Refractory Arch, Suspended.....Leaflet "Insulating Refractory Arch, Type ALR" gives details about new design featuring a dense refractory hanger which is applicable where there is rapid heating and cooling. 406A M. H. Detrick Co.
- Refrigerating Units.....Bulletin 97-F shows where low-pressure refrigeration units designed and built by Frick are working and what they do to satisfy the exacting requirements of the users.

 406B Frick Co.
- Thermocouple Assemblies..... New bulletin TA-457 illustrates and describes a wide variety of standard Serv-Rite thermocouple assemblies. Includes catalog numbers, sizes, prices and ordering information.

 406C Claud S. Gordon Co.
- Thermo-Panels.....Cost less and perform better—an improvement on pipe coils. Save space and heat or cool more efficiently. For use in heating and cooling of liquids, slurries, etc. Bulletins 355 and 257.

 TR426 *Dean Thermo-Panel Div.
- Tower, Cooling.....New 32-page Bulletin CT-57-1 describes induced-draft counterflow cooling tower. Lists advantages, describes construction and operation of all major parts, includes data sheet.

 406D Foster Wheeler Corp.
- Towers, Cooling.....Two brochures should prove helpful: "Comparative Performance of Cooling Tower Packing Arrangements" and "Answers to 15 Questions about Pritchard Induced Draft Cooling Towers."

 102 *J. F. Pritchard & Co.
- Traps, Steam.....Give faster. more effective condensate removal. Powerful valves action, positive shutoff, high capacity & each unit service tested. For more details, request new Bulletin No. 10-55.

 116 *W. H. Nicholson & Co.
- Traps, Steam.....Major reductions in steam trap installation and maintenance work and cost can be achieved by standardization on one make of trap—permits standardized hookups. Steam Trap Book. 99 *Armstrong Machine Works.

[•] From advertisement this issue

Instruments & Controls

Annunciator Systems.....New 32 p. catalog describes the complete line of standard, integrated Panalarm Annunciator Systems for industry. Company makes full details available in Catalog 100B, R420

R420 Panellit, Inc.

Comparators.....Fully illustrated, 100 p. handbook tells how to use pH and chlorine control for water supplies, process solutions, production pro-cesses in 34 basic industries. Covers complete line of comparators. 427 *W. A. Taylor & Co.

Computers, Digital.....E101 small electronic digital computer solves problems between the scope of desk calculators and costly "electronic brains", saves technical manhours. Request booklet. 191 *ElectroData Div.

Control, Pneumatic..... Standard and optional features of Speedomax G pneumatic controllers are covered in 12-page folder ND4(9). Block diagram shows how system works and details are illustrated. 407A Leeds & Northrup Co.

Control Systems..... Daystrom is com-piling a file of new applications of control systems and papers on vari-ous parts of systems, both industrial and military, with periodic additions.

*Daystrom Inc.

Controller, Concentration Detergent concentration is constantly controlled over a narrow range by a unique controller using neither vacuum tubes nor transistor cir-cuitry. TD 1245. 71-2j *U. S. I. Chemicals Co. cuitry.

Controllers, Electronic New 'American-Microsen' Series C100 electronic controllers can be interchanged at the panelboard in seconds. Better control, simplified servicing. Bul. RC100.

66 *Manning, Maxwell & Moore

Controls.....Annual equipment catalog lists coordinated group of instruments and controls that cover most aspects of measuring and controlling forces of flow, temperature, pressure, level, combustion.

407B Energy Control Co., Inc.

Controls, Electromagnetic Seven new catalogs have been issued on electromagnetic controls. They cover automatic transfer switches, remote control switches, contactors, relays, solenoids, complete line.

407C Automatic Switch Co.

Controls, Liquid Level..... Series 2800
for use as high and low limit
switches, to sound alarms, flash
signal lights, start or stop fluid
transfer pumps, operate control
valves. Request Bulletin F-2800.
119
*Fisher Governor Co.

Types H5 and H12 accurately and sensitively control liquid level alarms and air gas pressures. H5 controls up to 500 psi and H12 up to 180 psi. Bulletins 5-5 and 5-2.

306 *United Elec. Controls Co. Controls.

FOAM fouling up <u>your</u> process? PRODUCTION SHEE

Get a Dow Corning Silicone Defoamer!

Whatever your foaming problem, there's a Dow Corning silicone defoamer that will help solve it at an amazingly low cost.

Just a teaspoonful of a Dow Corning silicone defoamer can prevent mountains of foam . . . enabling you to utilize full productive capacity and put your processing into high gear. What's more, when you eliminate foam, you say goodbye to wasteful boilovers and the fire hazards they may present.

. . . So, stop frothing about those FOAM problems-eliminate them with a Dow Corning silicone defoamer. They're the most versatile and efficient foam killers ever developed!

FREE SAMPLE and INFORMATION-

To receive a generous trial sample of a Dow Corning Silicone Defoamer, return coupon below or write on your letterhead. No obligation, of course.



Dow Corning CORPORATION MIDLAND, MICHIGAN

NAME		2619	My foamer is
TITLE			Oll system
COMPANY			Food products.
CITY	ZONE	STATE	

[·] From advertisement this issue

Fansteel

Corrosionomics

COPYRIGHT 1956, FANSTEEL METALLURGICAL CORPORATION
A JOURNAL OF USEFUL INFORMATION FOR THE SOLUTION OF CORROSION PROBLEMS

Tantalum "U" Tube Heat Exchangers



By A. T. Bergstrom*

Since the tube side of shell and tube type heat exchangers is the "tightest" side, tantalum exchangers of this type are usually constructed so that the corrosive liquid being handled passes inside the tantalum tubes rather than around them.

Conventional fixed tube sheet exchangers are limited to tantalum tubes 6 or 8 feet long because of the 2½ to 1 ratio of thermal expansion coefficients of steel and tantalum. Further, examination and cleaning of the outside of the tubes is difficult.

The "U" tube or hairpin type tube bundle consists of tubes bent to a "U" shape with the both ends fixed in one tube sheet, so that with proper manifolding, the liquid enters and leaves the tubes at the same end of the exchanger. The exchanger can be made in a wide range of sizes by varying tube length and diameter, number of tubes, and shell dimensions.

, The advantages: (1) elimination of the differential expansion problem, (2) ease of inspection and cleaning of bundle and shell, (3) no internal gaskets, and (4) elimination of one tube sheet and its tantalum protective flange. The disadvantages: (1), difficulty of replacing individual tubes on inside bends and (2) inability to clean

*Chief Design Engineer, Chemical Equipment Division, Fansteel Metallurgical Corporation

**Registered trade mark, E. I. du Pont de Nemours & Co., Inc. mechanically the interior of tubes at the bends. (Tantalum, however, can easily be cleaned with hydrochloric acid.) The advantages, in most instances, obviously outweigh the disadvantages of this type of construction.

The seamless tantalum tubes are thinwall; 0.020" for ¾" OD tubes for 150 psig steam pressure in the shell, and 0.015" for ½" OD tubes for 200 psig steam pressure provide a safety factor of five. The tube bundle is held in a series of segmented steel baffles fastened together with tie rods.

Teflon ** grommets support the tubes in the baffles and permit their free movement.

The tubes are rolled into the steel tube sheet through copper ferrules, and after pressure testing, are arc welded to the tantalum tube sheet facing flange. Tantalum lined headers are bolted to the tube sheet, Teflon gaskets being used to provide a tight, leakproof joint.

Free Tantalum Test Kit

A corrosion test kit, available without charge to research technicians, contains both tantalum sheet and wire. Request it on your letterhead.

The above condensation is typical of articles which appear in

CORROSIONOMICS, a Fansteel publication. Mail us your name for inclusion on our mailing list.





For further data on the above, write:

FANSTEEL METALLURGICAL CORPORATION

CHEMICAL EQUIPMENT DIVISION NORTH CHICAGO, ILLINOIS, U.S.A. LITERATURE . . .

Controls, TemperatureBulletin 620 on Self-powered Temperature Controls, Bulletin 710 on Self-powered Cooling Controls, Bulletin 1025 on Electric Indicating Temperature Controls.

Controls, Temperature.....16 p. catalog presents company's line of standard local mounted temperature controls. Includes theory, features, general specifications, etc. Catalog Section 100.

408A United Elec. Controls Co.

Controls, Temperature, Pressure.....

More than 34 basic types of industrial temperature and pressure controls are described in a new industrial 96-page book. Devices control processes, heating, cooling, etc.

408B Powers Regulator Co.

Controller, Mercury-Actuated.....According to bulletin, a new mercury-actuated, air-operated indicating temperature controller can be changed from direct to reverse acting without tools.

408C H. O. Trerice Co.

Controllers.....Bulletin 5013 shows the basic advantages of the original Nullmatic controllers and M/P Control Stations. It also includes a number of improvements which have been added. Complete line.

468D Moore Products Co.

Controllers, Pneumatic 17 p. Bulletin 5013 contains application and operating data on a line of controllers which operate entirely on a balance of air pressures. Generously illustrated.

408E Moore Products Co.

Counters, Neutron..... Illustrated bulletin, Vol. 4, No. 2 of the RCL Counter, describes two new thermal neutron counters and company's new 1024-Channel Neutron Timeof-Flight Analyzer.

408F Radiation Counter Labs.

Detector, Methane..... Bulletin 0809-4
describes portable M-S-A type W-8
methane detector, which can quickly and accurately determine the
methane content of mine air. It is
extremely sensitive, easy to operate.
408G Mine Safety Appliances Co.

Detector, TDI..... A new, portable detector kit for low concentrations of Toluene diisocyanate and TDI-urea vapors in air, especially in plants making polyurethanes, is described in Bulletin 0811-4.

408H Mine Safety Appliances Co.

Gage, Ultrasonic Thickness....Bulletin V-200 gives complete data on the time-saving advantages of using the Vidigage ultrasonic tester to measure thickness of metal, plastic and glass; to find flaws. 4081 Branson Instruments, Inc.

Gages, Liquid Level..... New safety feature is an illuminated scale which starts flashing red if boiler water level gets too low or too high, flashes until situation is corrected. Bulletin. L424 *Jerguson Gage & Valve Co.

[•] From advertisement, this issue

Illuminator, Gage.....Data unit 300, 2 p., illustrates and describes com-pany's new liquid level gage il-luminator said to give three times the illumination previously possible. Explosion-proof.

Jerguson Gage & Valve

icators, Stabilized pH Offer these advantages: quick warm-up; fast response; measuring errors "designed out"; only two adjust-ments; fine performance. Informa-tion in Data Sheet E-96(2). 92 Leeds & Northup. Indicators,

Instruments..... A digest of specifica-tions of instruments and con-trols manufactured by this company is offered in their new 12 p. con-densed catalog. Can be had by writ-ing for Publication 57-687-297. 409A Hays Corp.

Instruments, Electronic Dynalog Electronic Instruments provide un-Dynalog interrupted evaluation of many process variables, sustained high accuracy. Dustproof, vibration-proof, foolproof. Bulletin 20-10. *Foxboro Co.

Mass-Spectrometer.....4 p. leaflet de-scribes company's inexpensive, small-size model for medical, industrial and university application. In-cludes information on applications, accessories, specifications.
409B Consol. Electrodynamics.

Measurement, Air Velocity.....Fully illustrated 20 p. booklet explains how company's Velometer can be used for measuring air velocities in large open areas, at supply openings, at suction openings, inside ducts.

409C Illinois Testing Labs.

Measurement, Surface.....4 p. research bulletin, No. 15, discusses surface measurements in the steel industry. Sections cover surface characteristics, appearance, roughness measurements, research.

409D Jones & Laughlin Steel Corp.

er, Flow.....8 p. booklet describes the turbine flow meter, a device for precise measurement of liquid flow. Inserted directly into process pip-ing, it accommodates a variety of liquids and flows ing, it accommod Fischer & Porter Co.

Meter, Pressure.....Catalog describes instrument for precise measurement of absolute, gage or differential fluid pressures over ranges from 0-4 psi. to 0-1,000 psi. with accuracy of 1 part in 2,000.

Fischer & Porter Co.

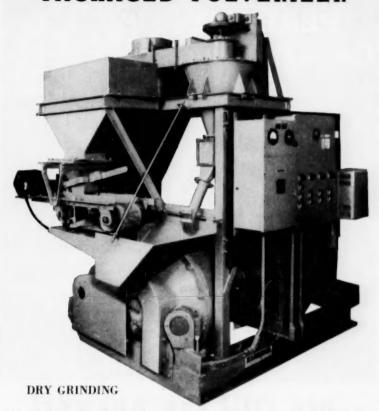
Meters, Survey A line of laboratory survey meters for detecting radio-activity are described in new bulle-tin G8-57. The instruments are used widely in laboratories to locate and measure radioactivity. 409G Nuclear Measurements Corp.

Panelboards.....QMB Saflex Distribu-tion Panelboards have quick-make, quick-break, horsepower rated switch unit. Ample space for easier wiring and maintenance, rugged, safe. Bulletin SD-29 available. 63 "Square D Co.

sture Testing.....New technical file is working guide for sealing vir-tually any type of hole for testing vessels or assemblies up to oressures of 1.500 psi. Covers standard and special plugs and connectors.

Mechanical Products Corp. Pressure 409H Mechanical Products Corp.

[&]quot;PACKAGED PULVERIZER"

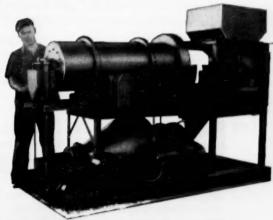


For any small-scale continuous dry grinding or pulverizing problem (such as is found in a pilot plant, laboratory or small commercial process) the Hardinge dry grinding unit is the solution. Completely self-contained and portable, this unit requires only power connections to be placed in operation. Includes Constant-Weight Feeder, "Electric Ear" grinding control, Conical Mill, "Gyrotor" Air Classifier, product collector and dust collector.

WET GRINDING

Hardinge builds a similar unit, (right) for small-scale, wet-grinding applications, including mill, classifier, feeder, "Electric Ear," and launders.

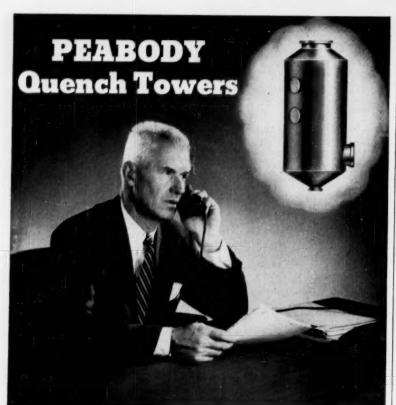
Bulletin AH-448-11.



OMPAN C ORP

YORK. PENNSYLVANIA 240 Arch St. Main Office and Works New York · Toronto · Chicago · Hibbing · Houston · Salt Lake City · San Francisco

[•] From advertisement, this issue



are still the answer!

* They quench, cool and clean gas-

A large oil company in Texas uses a Peabody directcontact quench tower in its ethylene plant. Cracked gas enters the tower at 600° F. and clean gas, cooled to 100° F., leaves at the rate of 103,500 C.F.M.

The Peabody Tower is adaptable to a wide variety of flow cycles. It quenches and cools high temperature gas from reforming furnaces or synthesis gas generators, and simultaneously removes particulate matter, such as tars and carbonaceous material.

This compact, low-pressure-drop unit provides minimum usage of low-pressure process water. It brings hot gas and coolant into intimate contact for positive mass transfer - gas can be cooled to within a few degrees of liquid inlet temperature. Outlet gas temperature and general performance can be held constant over a wide range of flow rates.

If you want clean, dry, cool gas, use a Peabody Tower.

PEABODY ENGINEERING CORPORATION

232 MADISON AVENUE, NEW YORK 16, N. Y. OFFICES IN PRINCIPAL CITIES PEABODY LIMITED . LONDON, S.W. 1, ENGLAND

7-101

LITERATURE . . .

Psychrometer.....How you can determine relative humidity with the Psychron, portable, battery-powered motor psychromator is told in a 4-page bulletin just released by the manufacturer Bendix Aviation Corp.

Pyrometers.....Alnor Pyrotac automatically protects furnaces, kilns and other heating equipment against damage due to excessive temperatures. Easily installed, low-cost reliable. Bulletin 2002.

83 *Illinois Testing Labs.

Recorder, Water Vapor.....Bulletin 0714-1 explains and illustrates the principle of operation of a continu-ous water vapor recorder for meas-uring low concentrations in streams of air or goze of air or gases.
410A Mine Safety Appliances Co.

Recorders, Water Vapor M-S-A continuous water vapor recorder is extremely accurate, records low concentrations of water vapor in gas or air streams and analyzes in range of 0 to 5000 ppm. Bulletin.

65 *Mine Safety Appliances Co.

Refractometer Process.....Bulletin 1833. 8 p. describes process refrac-tometer for monitoring and control of petroleum and chemical processes. What it measures, how it operates, automatic control. 410B Consol. Electrodynamics

Regulator. Self-Operating..... Bulletins 329 and 330 give information on regulator No. 11 which features a unique front-mounted dial thermometer to tell how the regulator is governing the temperature.

410C Powers Regulator Co.

rowers Regulator Co.

abilizer, Temperature A selfcontained temperature stabilizer,
quart size and factory sealed, has
been designed to maintain a specified temperature within insulated
packages. TD 1246.
71-2k *U. S. I. Chemi Stabilizer.

Tank Selector System Complete operational sequence, diagrams and illustrations for the Automatic Tank Selector system are contained in temporary bulletin 212. System con-trols tank filling operation. 410D Mason-Neilan

Temperature Monitors... ... For details aperature Monitors......For details on temperature monitoring systems see Thermo's new bulletin 72. It covers various standard sub-assem-blies and their arrangement into several-hundred-point systems. 410E Thermo Electric Co.

Thermocouples.....Miniature spring-loaded bayonet thermocouples al-ways give fast, dependable response. Can be used to measure tempera-tures at many different depths. Request Bulletin 2-E. T419 *Thermo Electric Co.

Thermocour'es & Accessories.....Bulletin 4181 lists thermocouples and accessories for every temperature measurement from —100 degrees F to 3000 degrees F. Bulletin 4257 on surface temperature items.

R422 *Illinois Testing Labs.

Thermometer Probe, Resistance....
By utilizing a grid of extremely fine platinum wire welded to platinum lead wires, this probe is capable of operation over the range of from 0 to 1200° C. Bulletin.

410F Arthur C. Ruge Assoc.

[•] From advertisement, this issue

Thermometers, Resistance New RdF Strapon resistance thermometer can be used in the presence of radioactive fields, high humidity, water, alcohol, salts, mineral and vegetable oils. Literature.

B425 *Arthur C. Ruge Associates.

Transmitters, Potentiometer.....Unit continuously standardized automatically; easy continuous adjustment of range span and zero suppression; both electronic and pneumatic units plug in, etc. Catalog 98262. 219 *Taylor Instrument Cos.

Vessel. Liquid-Metering.... Leaflet describes function of model 26 IM positive volume liquid metering vessel. Unit is designed for field metering of oil and water eliminating level controls. Delta Tank Mfg. Co.

Viscometer, Continuous.......Catalog VT-57 gives complete information about the Brookfield Viscometran and its applications to continuous in-process measurements and con-trol viscosity. viscosity.

Brookfield Engineering Lab.

Pipe, Fittings, Valves

Actuator, Valve... .. New 52-page catalog shows you how size and cost of hydraulic actuators for valves have been reduced successfully with new miniature line of hydraulic pumps, cylinders and pressure switches. Oil Dyne, Inc.

Actuators, Piug Valve.....Bulletins are available on a line of plug valve actuators now manufactured in valve sizes for 1 to 8-in. pipe. Units for 10 and 12-in. pipe sizes will be available are sizes. available soon. Pantex Mfg. Corp.

Couplings.... Durabla Reducing Cou-plings are now available to match Durabla Basic Check Units. This combination is all you need to form a low cost, all stainless-steel check valve. Bul. CE77. 314 *Durable Mfg. Co.

Couplings & Hose.....Packless pat-ented reusable couplings are hand machined of top quality brass, fitted without heat. Use them with Pack-less seamless drawn helical metal hose. Buls. DC & IND-4. 333 *Packless Metal Hose Inc.

Fittings, Drainage New line of PVC drainage fittings for carrying away corrosive waste liquids. Compared to cast alloys normally used, they cut labor and materials costs drastically. Bul. TTP 119.

*Tube Turns Plastics, Inc.

Fittings, Stainless Steel....Speedline fittings simplify pipeline design. Details of the greater design flexibility possible with Speedline fittings... at lower cost... available interactions. in catalog. 362 *Horace T. Potts Co.

nges....Long Life and precision workmanship are assured in Phoe-nix forged steel flanges. Meet full A. S. A. specifications—carbon steel and alloy. Write for 36 p. reference *Phoenix Mfg. Co.

• From advertisement, this issue



Tried it in your laboratory filter and it didn't work out? Couldn't get satisfactory flow rate or proper cake build-up? Process too slow? The material too viscous or gelatinous or what-have-you?

We've heard all these before. Yet we have proved a thousand times that what the user first considered a tough filtration assignment turned out a routine problem, readily solved in our laboratory. Of course, many problems were challenging, but Shriver experience and designs overcame them, too.

Shriver's long record in solving problems of filtration, washing, extraction or thickening, with the kind of filter press best suited to specific operating conditions, is your assurance of dependable service from laboratory to plant size equipment.

It will pay you to get the Shriver story. Use the coupon.





here's one that lasts

There's an element of abrasion, too, in addition to the heat and some corrosion. It's a 3-way problem which our metallurgists recognize and understand. Duraloy Flights used in many kilns are taking care of these three requirements very satisfactorily.

While chromium and nickel in varying proportions are the principal alloying elements in most high alloy castings, sometimes operating conditions call for several alloying elements and knowledge of how to use them to bring out certain special characteristics.

In our thirty-five years of high alloy casting experience we have encountered and solved some very difficult corrosion - temperature - strength problems. Perhaps we can help you in connection with your high alloy casting requirements.

OFFICE AND PLANT: Scottdale, Pa. EASTERN OFFICE: 12 East 41st Street, New York 17, N. Y. ATLANTA OFFICE: 76-4th Street, N.W.

CHICAGO OFFICE: 332 South Michigan Avenue DETROIT OFFICE: 23906 Woodward Avenue, Pleasant Ridge, Mich. Hose, Flexible Metal.....New 16-page brochure describes applications and uses of flexible metal hose and bellows. Detailed drawings and pictures make individual applications easy to specify.

Flexonics Corp.

Hose, Metal....Catalog 1D-100A, 10 p., covers company's range of flexi-ble metal hose with recommended pressures, temperatures and specific uses for which each type is suited. Photos show various types. 411F Universal Metal Hose Co.

Hose, Metal, Flexible.....Produced in various alloys of stainless steel—in monel, bronze, and carbon steel. Ideal for use with high temperature and high pressure corrosive gases. Bulletin 21-A. 33 *Atlantic Metal Hose Co.

ts, Expansion.....Free-flexing and controlled-flexing; dual and multiple types; balanced joints and other special designs; all in stainless steel, monel, and other workable alloys. See 28 p. Design Guide. 318 °Flexonics Corp. Joints, Expansion.

Nozzles, Spray Company provides a 48 p. industrial catalog with full data on thousands of standard and special nozzles—for every type of spraying. Also information on re-lated equipment. Catalog No. 24. T439 "Spraying Systems Co.

prator, Valve.....Complete line of power operators for actuating screwed-gland type, wrench-oper-ated values is cataloged in bulletin V-604. Size, cylinder diameter, cyl-inder stroke, price included. 412A Rockwell Mfg. Co. Operator, Valve.

Pipe, Aluminum.....Brochure "Key-nolds Aluminum Pipe for Tank and Vessel Hook-up" contains handy reference tables, scheduling sizes and specifications of pipe stocked by leading distributors across nation. 412B Reynolds Metals Co.

e, Plastic.....Complete line of plastic pipe, tubing and fittings is described in a new 16 p. catalog. Complete data and specifications for three grades of polyethylene pipe are included. are included. Franklin Plastics, Inc.

e. Plastic Ace Revivor is a rigid threaded plastic bipe with good aging and high impact strength. Not affected by most inorganic acids and alkalis. Company offers full details in Bulletin CE-56. 322 *American Hard Rubber Co. Pipe. Plastic.

Pipe, Stainless, High Alloy.....48 p. manual describes stainless steel and high alloy pipe and tubing ranging in size from ¹/₄ in. to 40 in. in outside diameter. Tables supply hardness, conversion, other data. 412D Trent Tube Co.

Pipe & Tubing.....New, illustrated 58
p. handbook backed with data on
stainless and high alloy tubing, including analysis and conversion
tables, corrosion characteristics,
weights etc. weights, etc. *Trent Tube Co. 353

Pipe & Tubing, Non-Metallic..... 4 p.
bulletin, "Fibercast Line Pipe and
Well Tubing" describes strong, corrosion-resistant pipe made from
thermosetting reinforced epoxy resins. 412E Fibercast Corp.

[·] From advertisement, this issue

- Process Pipe, Aluminum.....Booklets, "Corrosion Keys for Aluminum" and "Aluminum Process Pipe" explain advantages of aluminum pipe: low cost, resistance to corrosion, non-sparking, long life.

 221 *Reynolds Metals Co.
- Tubing, Armored..... Heavily armored construction of specially cabled copper tubes may be laid in a deep trench, protected by its lead sheath, asphalted jute, and other armor. Bulletin 356-H.

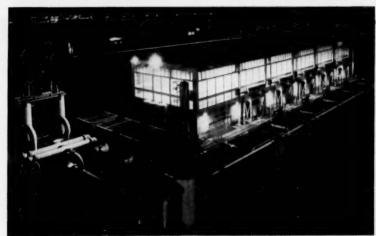
 B417 *Crescent Insulated Wire.
- Tubing, Steel.....Covered on a cardboard chart are tolerances for both seamless and welded mechanical tubing and seamless and welded stainless steel tubing and pipe. Permissible variations included. 413A Peter A. Frasse & Co.
- Tubing, Thermocouple Thermocouple tubing is described in Special Memo Analysis 118. Chemical composition, mechanical and physical properties for three special analyses as they relate to tubing.

 413B Superior Tube Co.
- Tubing, Zirconium.....Physical properties of zirconium and its alloys and mechanical properties of three different tempers of these metals have been tabulated in Special Analysis Memorandum No. 112.

 413C Superior Tube Co.
- Valves.....8 p. bulletin describes a line of non-lubricated, steamjacketed and non-jacketed plug valves for process industries. Covers two versions of basic internal fullopening design. 413D Alco Products, Inc.
- Valves.....Bulletin 70, 8 p., describes a new type of circulating oil system for application on presses, semiautomatic or automatic machine tools, with built-in return oil arrangements. 413E Farval Corp.
- Valves.....Ram type drain valve is illustrated and described in new 8 p. bulletin Dimensional and cutaway drawings as well as photographs show various models. Valves are said to eliminate clogding.

 413F Strahman Valves, Inc.
- Valves Line of general purpose valves for petroleum refineries, chemical plants. power plants. Includes gate, globe and angle type valves with hard faced seats. Supplement 1. to Cat. 24A-FC.

 236 "Henry Vogt Machine Co.
- Valves.....There's an Ace Hard rubber, rubber-lined, or olastic-lined valve for every corrosion application. Diaphragm, gate and check types. Lists chemicals handled in Billetin CE-52, Request your copy. 323 *American Hard Rubber Co.
- Valves. Check.....Fast, quiet operation means low cost operation for check valves...and that's exactly what the Chaoman Tilting Disc Check Valve is designed to do. Data in Catalog No. 30-A. 134 *Chapman Valve Mfg. Co.
- Valves. Diaphragm.....New catalog 104 describes exclusive features of Hills-McCanna diaphragm valves for positive closure and the latest in plastic valves and diaphragms for corrosive services. 413G Hills-McCanna Co.



Plant designed by M. A. Nishkian & Company, Consulting Engineers, Long Beach, Calif.

Repeat Performance in Long Beach

Here's how SWECO aftercoolers helped a big-city public utility meet the booming fuel needs of homeowners and industry.

More meals to cook, more homes to heat, new industry to serve. Those were the growing pains that challenged the Long Beach (Calif.) Municipal Gas Department in 1949. How Long Beach solved the problem is told in the efficient performance of four Sweco after-coolers that are currently processing 48,000,000 Std. cu. ft. of natural gas each day in a round-the-clock operation at the city's new Spring Street Compressor Station.

Each Sweco unit exchanges 2,422,000 B.t.u. per hour. Gas from the compressor enters the shell side of each after-cooler at the rate of 24,625 lb. an hour – and at a compression-developed temperature of 255°F. Cooling water in the tube bundle drops this temperature to 75°F.

Heart of system

The compressor station is the heart of a distribution system that depends on a constant, rigid level of pressure to push the gas through a network of lines to consumers. Pressure drops cost money. The plant's four Sweco heat exchangers keep pressure drop well within a tight specification of less than one pound per square inch.

Repeat performance

It was back in 1949 that the Municipal Gas Department ordered its first pair of big, custom-made Sweco after-coolers. But in just six years, even their peak processing performance of 24,000,000 Std. cu. ft. of natural gas every 24 hours proved inadequate. The gas department built a new plant, moved in the original two Sweco-built after-coolers, and went back to Sweco for two more units.

Common denominator

In ordering its second pair of aftercoolers, Long Beach joined an impressive list of repeat buyers of Sweco heat exchangers. All have this in common: the need for reliability.

That's why the process industries keep coming back to Sweco... for the design and manufacture of process equipment... for a full line of vibrating screen separators... for engineering and construction services.

Write today for our new brochure on how Sweco can help meet your processing needs – with heat exchangers, feed-water heaters, pressure vessels, distillation columns, steam jet ejectors and surface condensers, pilot plants, packaged heavymedia-separation units. Ask for brochure M-1-32.



Southwestern Engineering Company

4800 Santa Fe Ave., Los Angeles 58, Calif.

^{*} From advertisement, this issue

unharmed at 2000°F while

heat-resistant nickel-chrome alloy disintegrates

Exceptional resistance to oxidation, combined with great strength at very high temperatures, are characteristics of Kentanium, a titanium carbide composition. Here's proof.

A square of K161B Kentanium and a similar square of a well-known, heat-resistant 35 chromium-15 nickel alloy were exposed for 120 hours in an unsealed muffle furnace heated to 2000°F. The accompanying photographs vividly show how each piece was affected. While Kentanium is still good for hours of exposure at high temperatures, the nickel-chrome alloy has oxidized badly and has begun to disintegrate.

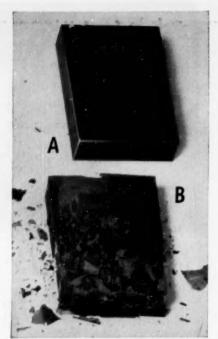
This demonstration suggests how well Kentanium will perform in such applications as furnace parts, heat-treating fixtures, quench guide rings, turbine blades, nozzle vanes, bushings and other parts where strength at high temperature, plus high resistance to oxidation, are factors.

Parts illustrated above are typical applications of Kentanium. The Kentanium series represents only a part of Kennametal's wide range of hard carbide compositions that are helping designers who require metals offering high resistance to abrasion, deflection, deformation, impact or corrosion. Perhaps one or more of these Kennametal compositions will help you get your idea off the drawing board into production. These materials are described and many applications discussed in two booklets: B-111-A—"Characteristics of Kennametal," and B-222—"Designing with Kennametal."

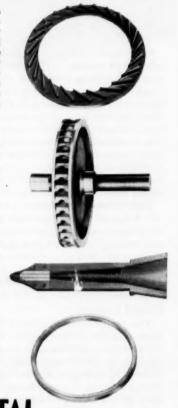
Write Kennametal Inc., Dept. CE, Latrobe, Pennsylvania.

... Partners in Progress

*Trsdemark e



(Photo A) Kentanium shows only slight oxidation after test and is good for many more hours' exposure at 2000°F. (Photo B) Hard nickel-chromium (35%) alloy is badly oxidized and began to disintegrate during test.





Valves, Diaphragm.....Neoprene diaphragm on Crane No. 1610 Packless Diaphragm Valves seals the bonnet without crushing and excessive wear. Wide selection of exclusive Crane valves. Folder AD-1942.

189 *Crane Co.

Valves, Diaphragm New booklet on positive flow control shows how simplified in-line maintenance and exclusive sealing bead diaphragm puts positive control in your flow system, saves money.

315 *Hills-McCanna Co.

Valves, Diaphragm Versatile Hills-McCanna diaphragm valves can handle corrosive or hazardous substances as well as air, water, normal liquid, gas and slurry flows. Request Catalog 104. 414A Hills-McCanna Co.

Valves, Drain Offers descriptive information on line of Strahman ram type valves ... the only drain valves that cannot clog up. Made in any cast metal to meet your requirements. Request Catalog.

L320 *Strahman Valves.

Valves, Gate.....Darling's fully revolving double disc parallel seat principle assures uniform wear distribution, automatic seating compensation, avoidance of disc-to-seat galling. New Catalog 57.

340 *Darling Valve & Mfg. Co.

Valves, Metering For precision, flow control use this brass bar stock metering valve, equipped with an O-ring stem seal. Offers precise control—20 turns moves stem only %". Bulletin BSV256.

T423 *Hoke Inc.

Valves, Needle....New Catalog halls the Marsh needle valve as the first throttling and shutoff needle valve suitable for working pressures up to 10,000 psi. which will also operate efficiently at low pressure. T428 Marsh Instrument Co.

Valves, Packless.... Fulton Sylphon packless valves are complete valves capable of mastering the toughest possible combination of conditions. Assure utmost safety. Request Bulletin 813-NC. 365 *Robertshaw-Fulton Controls.

Valves, Pinch.....Folder explains features of the Massco-Grigsby pinch valve which now incorporates an air-hydraulic opening and closing mechanism for improved operating results. 414B Mine & Smelter Supply Co.

Valves, Plug.....Homestead Lubricated Plug Valves have streamlined parts, controlled pressurized lubricant system, no overlubrication, triple head seal Request a copy of Valve Reference Book 39-5.

59 *Homestead Valve Mfg. Co.

Valves, Safety Relief.....Offer valuable features: economical "2 in 1" design; peak performance; absolute protection; maximum interchangeability. Full range of sizes and pressures available. Catalog No. 1900.

110 *Manning, Maxwell & Moore.

Valves, Semi Steel Revised 43-page bulletin (V-203, Rev. 1) supersedes earlier 35-page edition. Cutaway photos detail the working parts of four principal types of Rockwell-Nordstrom semi-steel valves.

414C Rockwell Mfg. Co.

[•] From advertisement, this issue

- Valves, Stainless Plug..... Line of stainless-steel, teflon-sleeved plug valves described in new bulletin S-1 are recommended for corrosives, solvent and slurries, and materials which interfere with seating. 414D Continental Mfg. Co.
- Valves, Stainless-Steel Bass....New type valve equipped with Tefion seals and trim in sizes from % to 2 in. is described in new 4-page leaflet. Valve has low-pressure sealing, operates easily.

 414E Rockwood Sprinkler Co.

Valves, Solenoid.....Bulletin GX sets forth details on new line of "All-316" stainless steel solenoid valves for corrosive gases and liquids. Valves are normally closed, angle pattern.

415A

J. D. Gould Co.

Valves, Solenoid Designs in ASCO's line of 2, 3 and 4 way solenoid valves included in catalog. Contains engineering information, flow charts, operation and construction details. Catalog 201. 115a Automatic Switch Co.

Valves, Solenoid....Bulletin 8210A describes Asco two-way solenoid valves in sizes ranging from % to 3 inches, with simple construction, ruggedness, freedom from porosity, compactness.

*Automatic Switch Co.

Process Equipment

Agitating Equipment.....For those interested in agitation in laboratory scale high pressure reactions Autoclave Engineers offers a free reprint of an April, 1957 article in Industrial & Engrg. Chemistry.

368 *Autoclave Engineers.

Agitators & Mixers Patented stand-pine around propeller shaft assures positive agitation and circulation, wearing plate presand-up on shut-down. Request a copy of Bulletin 42-B4.

402a *Denver Equipment Co.

Blender & Proportioner.....Bulletin
J-100 explains the features of the
Blendtrol device that maintains accurate flow rates in closed loops and
blends or proportions in open loop
systems.

415B Jordan Co.

Bienders, Liquid-Solids.....P-Kliquidsolids blenders intimately blend any liquid, regardless of viscosity, into dry solids in one step. Request Bulletin 15A (lab units), Bul. 7-15-A (production). 187 *Patterson-Kelley Co.

Cement Machinery....."Nordberg Machinery for the Cement Industry."
9-page catalog, covers this machinery; crushing screening, grinding, pyro-processing and power generation. Request your copy.

415c Nordberg Mfg. Co.

Centrifugals AT&M centrifugals are used in separation, dehydration, coating, filtering, impregnation and sedimentation processes. Maximum use of time and space, with safety. "Centrifugal Force."

93 "American Tool & Machine.



KIRK & BLUM oven removes 900 lbs. of water from 1700 lb. load . . .

. . . at Tennessee Eastman Corp. Kingsport, Tennessee

Special Design insures removal of moisture as it is taken up by the warm air, preventing re-deposit on other trays.

Steam heated, with adjustable controls and air circulating system for each compartment, the oven receives moisture-laden chemicals in trays, on trucks.

This 4-compartment feature allows removal of any truck at any time.

This 4-compartment dehydrating oven is another example of the wide diversification of drying problems solved by KIRK & BLUM Engineers.

The oven was shipped from the KIRK & BLUM plant completely assembled, thoroughly tested and ready to operate exactly as shown.

If you have an oven problem, discuss it with a KIRK & BLUM Engineer. There's no obligation. Write for free catalog, "Ovens for Industry".

KIRK & BLUM

INDUSTRIAL OVENS
THE KIRK & BLUM MANUFACTURING COMPANY
3208 Forrer Street • Cincinnati 9, Ohio

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 We have been supplying the chemical processing industry with tanks and vessels for chemical storage for three generations. In addition to carbon and stainless steel, we also fabricate and erect tanks, pressure vessels and processing equipment of aluminum and special alloys. . . . Investigate our facilities and take advantage of our 103 years of specialized knowledge and experience. . . . Write for Tank Talks.

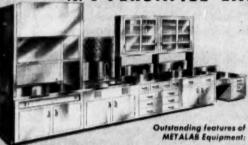


Elevated Tanks, Pressure Vessels, Chemical and Processing Equipment from Aluminum, Stainless and Carbon Steel, Monel and Other Alleys.

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Fireproof, waterproof, corrosion resistant, rustproof. Exclusive 5-point METCOTE protection throughout.

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The equipment shown here features entire units and iliustrates METALAB precision engineered interchange-able type construction.

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310 Duffy Ave., Hicksville, L. I., New York



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Please send us your 180-page Catalog 48.

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LITERATURE . . .

Centrifugals.....One Tolhurst Batch-Master centrifugal saves sixteen Master centrifugal saves sixteen manhours a day. Hydraulic un-loader and bottom discharge unload the solids in thirty seconds. Request new Bulletin TC-14-56. 335 *American Machine & Metals.

Centrifuges.....4 p. brochure on 16,-000-rpm., 400 ml. laboratory centri-fuge discusses specifications, motor and transformer characteristics, portability, applications, self-cen-tering direct drive assembly. 415D Ivan Sorvall, Inc.

Cleaners, Ultrasonic.....1 p. Product data sheet No. 1105 gives specifica-tions and applications for a new series of low cost ultrasonic cleaning units, ranging in capacity from 2 qt.

Alcar Instruments, Inc.

Coding Machine.....4 p. bulletin describes the coding and imprinting attachment for wrapping and bundling machines. Liberally illustrated with photographs and schematic drawings, bulletin shows many uses.

416B Adolph Gottscho, Inc.

Condensers, Vapor Contains diagrams and photographs showing apparatus for condensing vapors independent of a large supply of cooling water. For details on Aero vapor condensers, see Bulletin 129R.

338 *Niagara Blower Co.

.. Gruendler equipment for Crushers... shers.....Gruendler equipment for performance shredding, hogging, secondary grinding and refining of wood, wood wastes, barks and simi-lar oranic materials. Request a copy of Bulletin 930.

*Gruendler Crusher & Pulv. Co.

Crushers.....No. 13 Series Crushers are designed for capacities beyond those of lab mills and below those required for large-scale crushing operations. Equipped with rings or hammers. Catalog.

B423 *American Pulverizer Co.

457 gives specifications, descriptions, illustrations, cutting times and special features of a wide and varied line of abrasive cutting machines. Reouest your copy.

416C Beaver Physical Review Co. Cutting Machines...

. Davenport makes pressing. Dryers ers.....Davenport makes pressing, drying and cooling equipment, continuous dewatering presses, rotary dryers (steam tube, hot air, and direct fire), atmospheric drum dryers, etc. Catalog "A".

82 "Davenport Machine Corp.

ers.....Offer a variety of dryer models to meet all problems. De-signed to dry air, gases or liquids to sub-zero dew points at low cost. Constructed of quality materials. Details in Bulletin D-100. 55 °C. M. Kemp Mfg. Co. Dryers

Dryers Compact machine intro-duces dry, heated air through ever-changing channels reaching entire surface of every particle. Stratifica-tion and segregation prevented. Re-ouest a copy of Book 2511. 17 Link-Belt Co.

Dryers, Rotary.....Drying system for treatment of sewage sludge and industrial waste is described in 4 p. bulletin. It features 11 illustrations of the drying system including the rotary dryer itself.

416D Standard Steel Corp.

Dryers, Spray.....Bulietin 41 "Spray Dryers for the Ceramic Industry" tells how this equipment is applied to the drying of ceramic slips. The advantages offered by spray dryers are explained in detail. 416E Bowen Engineering, Inc.

Dust Collectors.....Field-proven Ducon Cyclones provide the continuous needed to capture nuisance dusts and recover usable product with no processing down-time for sludge clearance. Bul. DC-49. 307 *Ducon Co.

Dust Collectors New improved Dustex Collector with all-new tube design assures peak efficiency, self-cleaning action, greater capacity, less air flow resistance, etc. Literature.

B428 *Dustex Coro.

Dust Filters.....Sly dust filters offer advantages in greater filtering capacity, space-saving installation, automatic control, easier bag replacement. Full details in Bulletins 98 and 102.

326 °W. W. Sly Mfg. Co. Feeders.....Manzel chemical feeders are simple in design, ruggedly built, unfallingly accurate. Adjustable for metering any desired amount of liquid from 0 to 1 gailon per minute. Catalog.

319 °Manzel Div.

Feeders, Disk.....How the new Meco SRV variable-speed disk feeders accurately control feed rate of crushed or ground material is told in a descriptive bulletin. Units feed from 1 to 80 tons/hr. 417A Manufacturers Equipment Co.

Feeders, Vibrating.....Jeffrey electric vibrating feeders handle a tremendous variety of materials, densities from 4 to 400 lbs. per cubic foot, manual or automatic controls. Catalog 870.

*Jeffrey Mfg. Co.

Filter Cloth, Metallic Newark metalic filter cloth is available in a variety of weaves in all malleable metals, and is adaptable to practically all types of filters. Request further data in Catalog "E."

394 *Newark Wire Cloth Co.

Filter Fabrics.....The right fabric adds efficiency to continuous operation. Announces availability of a fully illustrated booklet. "Filter Fabric Facts," describing filter fabric development and application. 356 "Wellington Sears."

Filter Paper, Industrial.....Unique 24page Catalog 357 reviews filtration practice, explains how paper filter media help solve laboratory and process problems, helps you select correct grade for Job. 417B Eaton-Dikeman Co.

Filters Fulflo Filters for microscopic clarification of industrial liquids and various gasses with honeycomb filter tubes. Tubes available in nylon, orlon. dynel, acetate, glass. Catalog PM-200A.

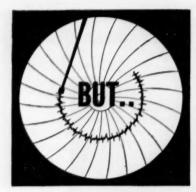
417C Commercial Filters Commercial Filters

Filters, Air.....Roll-o-matic filter curtains automatically roll up dust laden media and unroll clean media in proper amount. A single roll represents a full year's supply of clean air. Bul. 248. 366 "American Air Filter Co.





[•] From advertisement, this issue



Is Solvent Recovery Practical?

You bet it is! With a solvent recovery system, practically all kinds of volatile solvents and solvent mixtures can be recovered safely, efficiently, and economically. So, solvent recovery is practical because it means increased profits.

Here's why:

- The initial cost of a solvent becomes a secondary consideration. High priced solvents can be used at no extra operating cost.
- Solvents can be reused indefinitely.
 During periods of solvent shortages, efficient recovery is invaluable.
- Fire and health hazards are reduced and you have a closer check on solvent evaporation rates.

Solvent recovery plants are designed to suit your particular needs whether 50 or 100,000 gallons a day. In most cases, solvents can be recovered with an efficiency of more than 99% at a cost of 1 to 2¢ per pound. The investment is moderate too. Some recovery plants running at capacity pay for themselves in less than a year. Under other conditions, it takes only two or three years.

CARBIDE has much more information on how a COLUMBIA Activated Carbon Solvent Recovery plant can cut your processing costs. Write now!



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LITERATURE . . .

Filters, Automatic..... Versatile automatic filters provide double filter curtains, automatic control, rugged construction, protection of all moving parts, highest efficiency. Request Bulletin 500.

*Dollinger Corp.

Filters, Disc.....Special patented design of segments in filters use both gravity and vacuum to give a drier filter cake. Drainage is complete and positive with no blow-back. Details in Bulletin FG-B1.

402d *Denver Equipment Co.

Filters, Gas..... Staynew gas filters in natural and manufactured gas pipe lines remove dry oxide and sticky oily deposits, keep out lamp black and moisture. New feited dry-type medium. Bulletin 290-R. 418A *Dollinger Corp.

Filters, Instrument Air....Bulletin
IAF-856 shows how new instrumentair filters remove fine dirt particles
and entrained liquid droplets from
compressed air streams. Two types
for wide range of conditions.
418B Air-Maze Corp.

Filters, Nuclear Catalog 54-102 covers a complete line of filters and filtration systems for use in nuclear power and research applications. Lists 15 principal types of application for these units. 418C Cuno Engineering Corp.

Filters & Filter Tubes Fulflo filters clarify all types of industrial fluids: liquid chemicals, petro-chemicals, pharmaceuticals, water, compressed air, gases, oils. Request Bulletin AFD50-1B.

*Commercial Filters Corp.

Flame Cutter How you can save welding fittings by re-working, reconditioning and salvaging is described in a new bulletin on the Universal flame cutter. Series of pictures show how.

418D Vernon Tool Co., Ltd.

Flotation More large plants are installing "Sub-A's" for entire flotation job, because they give maximum recovery at a low cost per ton. Simplified continuous operating. Details in Bulletin F10-B81.

462e "Denver Equipment Co.

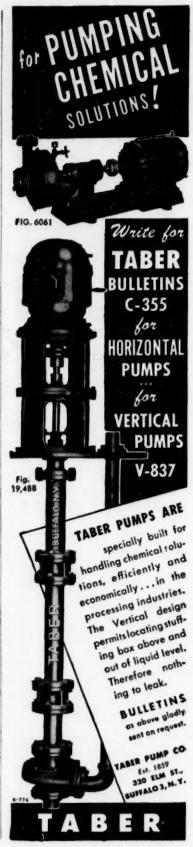
Fume Hoods.... New improvement gives you complete air flow control inside the fume hood by remote control. You can move the baffle by remote control and change the air flow with one motion. Bul. 56H. 316b *Laboratory Furniture Co.

Generators, Inert Gas.....New Sub-X inert gas generator uses submerged exhaust of combustion products, allows river water or other low-cost water supply as coolant. Compact, economical. Bul. 114. 339 *Thermal Research & Engrg.

Hydraulic Power Units..... A 52-page catalog just published contains complete technical data and specifications on hydraulic power units including pumps, cylinders, pressure switches and accessories.

418E Oil-Dyne, Inc.

* From advertisement, this issue



- Mills, Ball.....A steel-head ball mill will suit your particular need. Five types of discharge trunnions. All-steel construction. Low initial cost due to quantity production. Details in Bulletin B2-B13.

 402b *Denver Equipment Co.
- Mills, Imp.....Raymod imp mill is equipped to handle almost any combination of pulverizing, blend-ing, classifying, conveying and/or drying operation. For complete de-tails, request Catalog 77. 234 *Raymond Div.
- Mixers American mixers are com-pletely sanitary, as their spiral ex-peller ring assembly prevents shaft leakage. Removable shaft allows periodic take downs for cleaning. Free Catalog. 419A American Welded Tank Co. American Welded Tank Co.
- ters, Fluid.....New Philadelphia Mixers Catalog A-27 contains comprehensive mechanical design information permitting catalog selection of complete paddle and turbine type fluid mixers.

 21 *Philadelphia Gear Works, Inc.
- Mixers, Pipeline..... Nettco Flomix for continuous pipeline mixing, increased product uniformity, simplified piping layouts. Suitable for high capacities, pressures and temperatures. Bulletin 531.

 68c *New Eng. Tank & Tower Co.
- Mixers. Portable & Tripod....Nettco portable and Flange-Mounted mix-ers furnish drip-proof construction, high or medium speed, top efficiency drive, oversized bearings, etc. Speci-fication Sheets. fication Sheets. fication Sheets. Tank & Tower Co.
- Mixers, Tank Top.....Model WT and Model T tank top agitators feature clean, efficient designs with minimum moving parts. Variety of motors, shafts, stirrers and supports. Bulletin 551.

 68a *New Eng. Tank & Tower Co.
- Nuclear Purifier..... How can you purify contaminated streams of dangerous radioactivity is told in a leaflet that describes the model XP15 nuclear purifier, a disposable package unit.

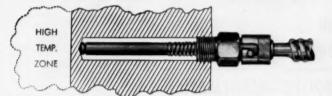
 419B Permutit Co.
- Pneumatic Specialties.....Folder F-15B illustrates line of pneumatic specialties and lists specifications together with operating character-istics and advantages. Filters, regulators, lubricators, accessories.
 419C Watts Regulator Co.
- ses. Filter.....Sperry Catalog complete with charts, tables, and diagrams, will help you in the op-Presses. eration, maintenance and selection of filtration equipment. Request your copy of Catalog 7-E.

 403 *D. R. Sperry & Co.
- Pressure Vessels.....Outline of company's ability to supply evaporators, extractors equipment design and drawings, piping, pilot plants, towers and heat exchangers is contained in 6 p. folder.

 419D Vulcan-Cincinnati, Inc.

Spring-Loaded Thermocouples Assure Dependable Contact

Field-Proven By Many Years' Successful Use



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In Canada – THERMO ELECT. You always get fast, dependable response from T-E's miniature bayonet thermocouples because (1) spring-loaded hot junctions are always held in tight contact with the measured surface—regardless of expansion and contraction, and (2) the 'couples themselves are extremely sensitive to temperature changes. They are widely used with cylinder heads, extruders, heat transfer lines and other similar applications. Adapters of different lengths permit use of one thermocouple to measure temperatures at many different depths. Specially designed, patented, pipe-clamp adapters are also available. Bayonet-lock caps provide quick, easy removal. Lead connections are supplied straight or with 45° or 90° angles. All probes and adapters are of Stainless Steel. Available in

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For price and terms outside U. S. write McGraw-Hill Int'l., N.Y.C.	CE-7

LITERATURE . . .

Process Equipment.....32 p. bulletin covers all Allis-Chalmers equipment covers an Anna-Chaimers equipment for the process industries. This bulletin, as well as literature cover-ing specific equipment lines, is available. Bulletin 25C6177J. 113 *Allis-Chalmers Mfg. Co.

Process Equipment Pfaudler Buy-er's Guide covering the firm's corro-sion-resistent process equipment. Information on custombuilt equip-ment, columns, condensers, tanks, etc. Bulletin #936. 48-9a Pfaudler Co.

Process Equipment.....Sweco designs and manufactures reliable process equipment, including heat exchan-gers, feed-water heaters, pressure vessels, distallation columns, etc. Ask for Brochure M-1-32. 413 *Southwestern Engineering Co.

Process Equipment... Hardinge builds self-contained portable dry grinding unit for small-scale continuous dry grinding or pulverizing and similar wet grinding unit. Bulletin AH-448. 469 °Hardinge Co.

cess Equipment.....New 12 p. booklet "An Open Door" shows how Swenson can assist in solving your processing problems. Planning, sur-veillance of operation, post-installa-Process tion checks.
*Swenson Evaporator Co.

Process Equipment.....Company offers technical bulletins on agitators, portable mixers, mixing and extrud-ing machinery, dry blenders, ribbon mixers, grinding and mulling pans,

mills, etc. Free. 285 °International Engineering

pellers Smooth, vibrationless propellers for mixing, stirring, aerating, pumping, etc., perfectly balanced to avoid whip and strain on the shafts. Sizes up to 60°. Re-quest latest data folder. BR424 *Michigan Wheel Co. Propellers

Reactors, Stainless.... Bulletin 944, 16
p., lists the latest sizes and styles of
stainless steel reactors marketed by
this firm. Covers twees of fabricated
products, properties of alloys used.
Request your copy.
420A Pfaulder Co.

Reactors, Stainless Steel.....Pfaudler designs include such features as— heavy duty drives, properly engi-neered agitation systems, rotary seals or stuffing boxes, baffles, ther-mometer wells, etc. Bulletin 944. Request your copy. Pfaudler Co.

*Denver Equipment Co.

Screens, Vibrating Gives fast, clean separation without blinding. Even, smooth flow of material because of patented "true-circle" eccentric action. Full details available in Bulletin 83-B11.

402h "Denver Equipment Co.

sens, Vibrating . . . Vibrating screens for accurate dry screening of light or fine materials. Sizes closely through small screen openings; screens corrosive and toxic chemicals safely. Book No. 2377.

Link-Belt Co. Screens, Vibrating

· From advertisement, this issue.



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Panellit Service Corporation

Separator, High Tension. ... New high tension separator for laboratory and pilot plant use is described in 2 p. bulletin HBP-103. Design characteristics, power requirements, operation and application data.

Carpco Mfg., Inc.

Separators, Air.....Controlled centrifugal whir l by balancing forces separates rapidly, efficiency, cement, lime, clay, tale, ceramics, refractories, phosphates, coal, other materials. Bulletin 087.

100 *Sturtevant Mill Co.

Speed Variators.....Cleveland Speed Variators give stepless speeds over a full 9:1 range, % to 3 times input speed. Output speed manually or automatically regulated. Bulletin K-200. 12 *Cleveland Worm & Gear Co.

Spray, Launder..... Leaflet tells how non-clog launder sprays can reduces plant launder spray water consumption from 40% to 60%. Durable, resilient rubber diaphragm ejects foreign matter.

ainers Yarway fine screen straining protect equipment, pre-vent dirt, scale, chips, welding dross, etc. from reaching working parts. Screen is easily removed for clean-ing. Bulletin S-204. 171 "Yarnall-Waring Co. Strainers

Thickeners.....Enclosed, running-in-oil tread motion. Patented spiral rakes move settled solids to center discharge with continuous motion, rapid removal of solids tends to eliminate overload. Bul. T5-B5. 402i *Denver Equipment Co.

Vaporizers.....Engineers analyze entire process system before recommending the proper high-temperature, low-pressure vaporizer. They design, build, install, and service vaporizers. Bul. ID-54-5.

125 "Foster Wheeler Corp.

re Cloth.....90 p. catalog describes company's facilities for fabricating wire cloth parts. Wire cloth parts for screening, filtering and special uses. Provide useful metallurgical data. Request your copy. 342 *Cambridge Wire Cloth Co. Wire Cloth

Wire Cloth & Filter Cloth.....All standard grades of wire cloth, filter cloth, Neva-Clog metal sheet filter medium, Mykro-Pore metallic filter-ing or straining medium and fabri-cated components. Cat cated components. Cat.
L399 *Multi-Metal Wire Cloth Co.

Wire Rope.....Complete line of pre-formed wire rope, wire-rope acces-sories and boom-cable assemblies are discussed in 16-page bulletin DH-129-B. Covers construction fea-tures, applications, diameters. 421B American Chain & Cable Co.

Pumps, Blowers, Compressors

Blowers & Fans.....Un-plasticized rigid polyvinyl chloride blowers and fans—143 to 15,000 cfm—for ex-hausting corrosive air, fumes and gases. Centrifugal blowers—axial fans. Pull details in bulletin. 421C Industrial Plastic Fabricators.



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Compressors.....Complete line of electric-driven, steam-driven, gas-engine, and centrifugal compressors backed by many years of experience in designing and building compressors. Form 3132A.

61 *Ingersoll-Rand Co.

Compressors....Describes Allis-Chalmers single and two-stage vane type compressors for shop air, gas handling, drilling and numerous other applications. Bulletin Nos. 16B8244 and 16B8126. 229 *Allis-Chalmers Mfg. Co.

Compressors Nash compressors have no internal wearing parts, no valves, pistons or vanes, no internal lubrication, low maintenance cost. They save floor space, have long life. Bulletins.

128 Nash Engineering Co.

Compressor, Air.....Features offered by the new Channel-Flo, 2-stage, 200 psig. motor compressor are set forth in 8-page bulletin Form 1547. Unit includes important safety and space-saving features. 422A Ingersoll-Rand.

Compressors, Integral Diesel....New Bulletin, Form 3207, features integrally built, diesel-engine compressors for industrial plants, mines and chemical plants. Four-cycle V engine drives compressor. 422B Ingersoll-Rand.

Compressors, Oil-Free Joy Oil-Free Compressors use carbon piston rings that require no lubrication, with no oil in the cylinder, and no oil in the compressed air. Request a copy of Bulletin 167-11.

*Joy Mfg. Co.

Fins, Industrial..... Stainless Steel General Industrial Fan resists injurious fumes while operating at top efficiency at temperatures up to 800°F. Details made available in Bulletin No. 521. 87 *New York Blower Co.

Pump, Duplex.....Catalog now available gives details on new duplex flex-i-liner pumps which double the capacity of largest previous unit. Fluid contacts only outer surface of flexible liner, has no seals.

422C Vanton Pump & Equipt. Corp.

Pump, Lab Type.....Leaflet tells about new model T-8 Sigmamotor pump for capacities from 0.1 to 250 cc./ mln. Steel fingers malpulate tubing to pump liquid without contacting pump mechanism. 422D Sigmamotor, Inc.

Pump, Laboratory Metering.....Technical guide No. 10 explains how the Kinetic Clamp applies pressure externally on a flexible tube to cause liquid within the tube to flow at a controlled rate.

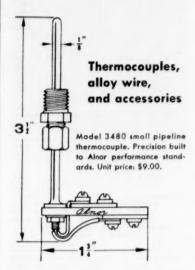
422F Cornell Associates.

Pumb. Rotary-Vane Air.....Bulletin
VP-557-13 describes the new model
4565 rotary-vane air pump which
delivers 45 cfm. As a compressor it's
used to atomize fuel oil on industrial burners.
422F Gast Mfg. Corp.

Pumps.....A well illustrated 4 p. flyer
Form 7444 describes a line of circulating and coolant pumps for
sidewall or immersion mounting.
They have no stuffing boxes, no
pump bearings or couplings.
4226 Ingersoll-Rand.

• From advertisement, this issue.

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Pumps, Canned.....Bulletin entitled
"The Corley Magnafice, Simplest
Pump You Ever Saw" lists the advantages of fractional horsepower
canned pumps as compared with
conventional centrifugal pumps.
423A Corley Co.

Pumps, Centrifugal.....Bulletin D-3 describes a pump for easy mainte-nance by removal of working parts as a unit separable from piping system. Specifications, hydraulic and mechanical design data. 423B

Pumps, Chemical.....Goulds Fig. 3715 chemical pumps protect against four types of corrosion, galvanic, uniform, intergranular and pitted. Comes in 9 sizes, many metals. Request Bulletin 7204. 337a *Goulds Pumps Inc.

Pumps, Chemical.....Bulletin 721.6 describes Gould Fig. 3405 corrosion-resistant chemical pump. Comes in 19 sizes, with capacity to 6400 GPM, head to 425 ft. Single stage, double suction. *Goulds Pumps Inc.

Pumps, Chemical......Bulletin. 722.6 describes Gould Fig. 3405 chemical pump. Comes in eight sizes, capacity to 1200 GPM, head to 1000 ft. Two-stage, opposed impellers, corrosion-resistant. 3376 *Goulds Pumps Inc.

Pumps, Chemical. Bulletin 720.4 describes Gould Fig. 3189 corrosion-resistant chemical pump. Comes in 11 sizes, capacity to 1080 GPM, head 180 ft. Single stage, open impeller.
7d *Goulds Pumps Inc.

Pumps, Chemical.....Bulletin covers
Warren rubber lined chemical
pumps—Type DB. Gives service
characteristics, construction, advantages, dimensions and specifications.
Bulletin WQ-212.
423C Warren Pumps Inc. 423C Warren Pumps Inc.

Pumps, Corrosion-Resistant. Waukesha corrosion-resistant pumps provide a positive product seal without using troublesome packing glands. Low maintenance cost. Request latest catalog. 400 °Waukesha Foundry Co.

Pumps, Double Suction.....Hydraulically balances, efficient and durable, in sizes to deliver from 10 to 14,000 gpm for circulating, air conditioning, other plant services. Details in Bulletin 955.

214 *Buffalo Pumps.

Pumps, Horizontal & Vertical....Com-pany offers Bulletin C-355 for hori-zontal pumps and Bulletin V-837 for vertical pumps, with stuffing box above and out of liquid level; leaks. R418 *Taber Pump Co.

Pumps, Industrial.....Jabsco Industrial Pumps; instantly self-priming; simple, compact, only one moving part; durable neoprene impeller; self-lubricated; trouble-free operation. Catalog sheets available.

432

*Jabsco Pump Co.

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[·] From advertisement, this issue.



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LITERATURE . . .

Pumps, Piston-Diaphragm...For controlled-volume pumping of fluids. Flow-charts, typical applications and specifications and models of various capacities and constructions in Bulletin No. 440. 129 "Lapp Insulator Co.

Pumps, Pit.....Company offers free catalogs on Heavy-Duty Vertical Wet Pit Pumps for solids-free liquids. These pumps save space and money, stop leakage. 397 Yeomans Co.

Pumps, Positive "How Industry Profits With Viking Pumps" presents application material in industries such as petroleum products, chemicals and foods. Tells about 750 catalog models, many specials. 424A Viking Pump Co.

Pumps. Sand....Rubber lined sand pumps lower pumping costs 30% to 70% due to simple design and accuracy of rubber parts which increase efficiency 1% to 3 times over other sand pumps. Bul. P9-B8. 402f *Denver Equipment Co.

Pumps, Screw....Bulletin S-206, 6 p., shows basic construction and design of a line of standard screw pumps. Double external bearing and geartype, and double external bearing and gear hopper type.

424B Warren Pumps, Inc.

Services, Processes, Misc.

Calculator.....Handy pocket slide calculator for figuring water pipe and paper stock pipe friction iosses. Measuring 9¼ by 4 in., it carries a table of equivalent lengths for new valves for turbulent flow. 424C Allis-Chalmers Mfg. Co.

Cleaning Process Equipment Use in-place chemical circulation to clean towers, tanks, pumps, compressors, lines, fittings and other process equipment quickly, safely. Technical Bulletin.

343 *Oakite Products Inc.

Construction Atlas gives a completely integrated construction service which will accept full and sole responsibility for your job and will guarantee every aspect of it. Bulletin CC-3.

405 *Atlas Mineral Products Co.

Design, Heat Exchangers.....When heat transfer specifications call for aluminum, aluminum bronze, nickel, copper, stainless steel, or almost any clay or alloy, Downington understands problems. Booklet.

14 *Downington Iron Works.

Design & Construction Chemical & Industrial Corp. designs and builds chemical plants throughout the world, including nitric acid, complex fertilizer, phosphoric acid, etc. Brochures.

275 *Chemical & Industrial Corp.

Dyeing, Textile......12 p. bibliography lists major technical literature on textile dyeing, printing and finishing. Compiled by the Manchester Library, Manchester, England. Covers the past 30 years. 424D Royce Chemical Co.

* From advertisement, this issue.

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NO. 930



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Southwestern Engineering Co.

Equipment, Laboratory.....24 p. bro-chure describes design and applica-tions of a variety of excitation source units and discharge stands used in spectro-chemical analysis. Detailed specs or photographic tests. 425B Jarrell-Ash Co.

Fire Extinguishing Systems, Carbon Dioxide.....Features: all operating parts completely enclosed, no clumpsy triggering methods or falling weights, self-contained, easy testing of all parts. Booklet.

312 *Walter Kidde & Co.

Fire Protection Systems Complete discussion of the nature and advantages of fire protection systems is found in 36-page Bulletin 66, "The ABC of Fire Protection." Components and systems are included.

425C Automatic Sprinkler Corp.

Furniture, Laboratory.....24 p. bulle-tin describes specifications for over two dozen interchangeable direct-from-stock furniture units for clinical, chemical, metallurgical, educa-tional and pathological laboratories. 425D Fisher Scientific Co.

Furniture, Laboratory Company offers valuable free planning aid, revised edition of "Steelab" with hundreds of useful ideas for laboratory furniture layouts. Request your copy now.

310a *Laboratory Furniture Co.

Glass, Commercial.....Bulletin B-83, 16 p., discusses mechanical, thermal, electrical and chemical properties of glass. Viscosity temperature curves for several commercial glasses, heat transmission data. 425E Corning Glass Works. Corning Glass Works.

Glassware, Laboratory Catalog 80C100, 16 p., gives specifications and prices on precision-bore bur-ettes, aspirator bottles, gas collect-ing tubes, Karl Fischer apparatus, separatory funnels, etc. 425F Fischer & Porter Co.

High Polymer Alkyd Technique.....
The High Polymer Alkyd Technique involves the formation of a greater proportion of high molecular weight alkyd fractions by stepwise esterification. Paper available.

177 *Heyden Newport Chem. Co.

Hydroforming.....4 p. bulletin de-scribes a complete hydroforming service for producing short run and development components serving industries such as automotive, guided missiles. electrical. 425G C. B. Kaupp & Sons.

O.VEYORS FOR MULTI-PURPOSE HANDLING AND PROCESSING OF BULK MATERIALS This popular type of Ajax open pan Lo-Veyor is used extensively where there are no contamination problems.

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5 Broadway, New York 4, N. Y.

Instruments, Laboratory . Bulletin 19, 12 p., describes several new in-struments in the electrochemical, spectrophotometer and gas analysis product fields. Includes photographs and operation diagrams.

425H Beckman Instruments, Inc.

Laboratory Equipment & Furniture
.....Sectional units designed for
interchangeability & flexibility assure a synchronized installation for
peak efficiency, 180 p. Catalog 4B &
Supplement 55-A.
B416 °Metalab Equipment Corp.

Optics, Infrared Bulletin O-105, 2 p., describes infrared optics ex-pressly for use in hyper-sensitive infrared systems. Graphs show properties of optical grade high purity silicon used in IR systems. 426A Texas Instruments, Inc.

Optics, Precision.....Bulletin O-104, 6
p., describes engineering and production of flat, cylindrical, prismatic, spherical and aspherical components for fire control, photographic, projection, and other uses.

426B Texas Instruments, Inc.

Plant Layout Kit.....Planning cube provides three-dimensional layout right in the engineering department. With kit described in brochure you can see what are best locations and can see what correct errors. Visual Plant Layouts.

Product Development Brochure, "How to Develop Successful New Products," describes principles and Brochure, case histories of a consultant in the product development field. Includes research, testing, finance. 426D Foster D. Snell, Inc.

Public Relations, Atomic.....A new book on public relations for the atomic industry discusses the atom as news, what the public wants to know about it, sources of information and techniques. TD 1249. 71-2n *U. S. I. Chemicals Co.

Recorder, Laboratory "Scientific Apparatus and Methods," Vol. 9, No. 2, covers a new multi-range ver-tical strip chart recorder for the lab bench. Includes latest catalog revisions on company's line. 426E E. H. Sargent & Co.

Refinery Design.....American Oil Co.'s new refinery at Yorktown, Va., is described with detailed sections on the major areas. The 16 p. booklet covers the combination, product transfer facilities, effluent treating. 426F M. W. Kellogg Co.

Repair Kit, Emergency.....Kit for re-pairing tanks, pipes, pumps, valves, flanges, air ducts, and miscellaneous machinery used by the oil, chemical, mining and other industries. See Bullette Bulletin. Devcon Corp.

Safety.....Bulletin FS 201 "Manual of Laboratory Safety" covers accident prevention, first aid, fire prevention, safety equipment and includes a safety bibliography. Covers radioactive materials.

426H Fisher Scientific Co.

Testing, Laboratory.....Testing laboratory facilities for complete batch ratory facilities for complete batch or pilot tests. Ample test facilities for investigations on crushing, grinding, mixing, classifications, separation, etc. Bulletin T4-B15. 402J *Denver Equipment Co.

Testing Machine.....Operating infor-mation on a lubricant-friction-wear testing machine is incorporated in 2 p. bulletin 106. Lists specifications in both the English and metric sys-Alpha Molykote Corp.

HOW TO HEAT TANKS THE MODERN WAY

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Bulletin 355 52 pages. Technical Data

Bulletin 257
Design and Price Information.

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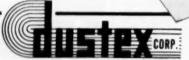
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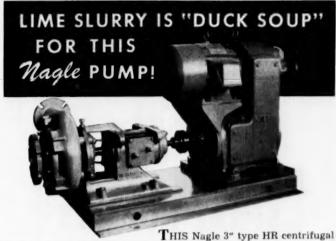
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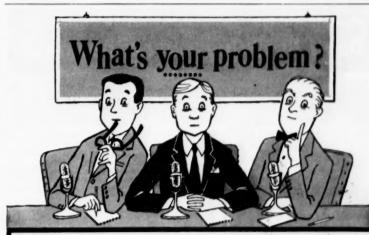


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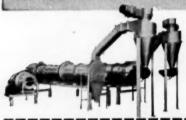
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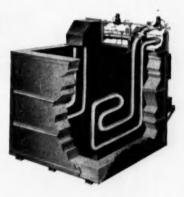
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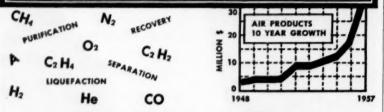


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- Syntron Spiral Vibrating Elevators. 8'6" 116
- -Jeffrey Vibrating Conveyors, Model FO#3 MC-6, 9' long each
- 4—Jeffrey Vibrating Conveyors, Model #2AH 15' long each 8—Jeffrey Feeder-Spreaders, FO#3 AC, 12" x 30" w/covered decks



CENTRIFUGES (cont.)

- 2-Bird 40" x 60" 304 S.S. 30 HP explo-
- sion proof motor
 2—Sharples C-27 Super-D-Hydrators, 316
 S.S. with 30 HP explosion proof
 1—Delaval ACVO S.S. 20 HP Motor
 1—Delaval Model AAK1, 7½ HP Motor

- 2—Niagara Model 510-28, S.S. leaves 1—Sweetland #2, 9 lvs on 4" centers 2—Sweetland #7, with 41 leaves 2" cen-
- ters, 20 leaves 4" centers
 Sweetland #12, 46 leaves 3" centers,
 30 leaves 4" centers
 Cliver 1" x 1" Rotary Continuous Stainless Steel Precoat

- Oliver 3' x 2' Rotary Vacuum
 Oliver 6' x 6' Salt type, Rotary Continuous Vacuum
- Eimco 8' x 8' Rotary Continuous Oliver 8' x 10' Continuous Precoat
- Shriver 30" x 30" plate and frame, 32 chambers Shriver 36" x 36" 20 frames 19 plates
- Sperry 36" x 36", 60 recessed plates

KETTLES

- Groen Model RA 60 gal. S.S. agit. New
- Groen Model TA 100 gal. S.S. agitated
- Lee 125 gallon S.S. 90# jacket Lee 250 gallon S.S. 90# jacket Sweco 1000 gal. Steel, Closed, jacketed, Agitated, 150# PSI jacket and internal
- 1000 gal Steel, open top, jacket and Agitated, 100 PSI

MISCELLANEOUS

Agitators, Lightnin Model SEV 2500 sideentering, 25 HP spl prf (8)
Separator, Raymond 4' double Whizzer
Screen, Tyler, 4' x 5' S.S. Hummer (2)
Crusher, Penna. Reversible 350 HP motor, size 15" x 58" Crystallizers, Swenson-Walker each 20' long, with individual drives Press, Valley, 16" dia. S.S. Twin Screw, Model D342 continuous

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- 3-Bartlett & Snow 7' x 30', 6' x 30' direct
- heat Rotary.
 1—Christie 70" x 40' indirect heat Rotary.
 3—Link Belt 5'2" x 20', 6'4" x 24', 7'5" x

- 25'.
 Devine double door Vacuum Shelf 17
 and 20—59" x 78" shelves.
 Devine single door Vacuum Shelf 17
 and 16—40" x 43" shelves.
 Stokes single door Vacuum Shelf 4, 6
 and 9—24" x 36" shelves.
 Devine 5' x 33', 4' x 25' Rotary Vac-

- uums.
 Devine 5' x 10' Rotating Vacuum.
 Hersey 1½' x 12' Rotary, 304 S.S.
 Louisville Steam Tube 6' x 30', 6' x 35', 38'' x 25'.
 Buflovak Atmospheric double drum 42'' x 120'', variable speed drive.
 Buflovak 5' x 12' Atmospheric single drum.
- Devine 4' x 9' Atmospheric single drum.

 Tray Dryers, steam heated, 95 sq. ft tray area.

FILTERS

- -Sparkler 33.5-28, 150 sq. ft., 304 S.S.
 -Sparkler #14-D.4, 304 S.S. NEW.
 -Oliver Rotary, Monel 8' x 10', 3' x 2',
 -Oliver 3' dia. Monel Horizontal.
 -Oliver 5'3' x 8' Steel Rotary Vac.
 -Ei.co 18" x 12" 316 S.S.
 -Sweetland #12, 48 and 32 leaves.
 -Sweetland #7, 20 S.S. covered leaves.
 -Shriver 30" P&F, 36 Chambers, iron.
 -Shriver, 30" P&F, 40 chambers, Heresite coated.

CENTRIFUGALS

- 5—Bird 32" x 50" solid bowl Continuous
 Centrituges 316 5.S. fume-tight, 60 HP,
 TEFC motors, NEW 1953.
 2-Bird 36" x 50", 18" x 28" steel, solid
 bowl, continuous.
 2-Bird 24" x 38", 18" x 28", 316 S.S. Solid
 Bowl, continuous.
 1-Sharples #C-20, 316 S.S. Super-D-Hydrator.

- drator. Sharples #C-27, Monel Super-D-Hydra-
- -Sharples 2C-77, Mone: Super-D-Hydractors, New.
 -Sharples PY-14, Super-D-Canter, 304 S.S.
 -Bird 40" suspended, 347 S.S.
 -A75M 40" suspended, steel.
 -Bird 40" suspended, rubber.
 -Tolhurst 40" 32", 28" suspended.
 -A75M 36" center slung, rubber covered,
 perforated backet.
 -Tolhurst 32" Suspended, 304 S.S., perforated backet.

EVAPORATORS, REACTORS CONDENSERS, TOWERS, TANKS

- l—Artisan 450 sq. ft., 304 S.S., single effect Evaporator, complete with piping, receiver, separator and condenser.

 Nooter 1000 gal. nickel-clad, jacketed, agitated Reactor.

 Glascote 500 gal. glass lined, jacketed, agitated Reactors.

 Pfoudler 250 gal. glass lined, jacketed, agitated Reactors.

 Pfoudler 500 and 300 gal., glass lined jacketed Reactors.

 1-750 gal., 304 S.S. Keitle with coils and paddle agitator.

 1-600 gal., 318 S.S. jacketed, agitated Reactor 2002 internal pressure, 75# jacket.

- jacket.

 2-500 gal., 347 S.S. jacketed Autoclaves or Reactors, 300# int. pressure, ASME.

 1-500 gal., 318 S.S. closed, jacketed Tank.

 3500 gal., 304 S.S. jacketed, agitated Tanks.

- Tanks.

 Wyatt 18" dia. x 23', 316 S.S. Bubble Cap Column.

 Wyatt 24" dia. x 42', 304 S.S. Bubble Cap Column.

 10' dia. Hortonsphere, 225 psi.

 10.000 Aluminum Storage Tank 16' x 16' x ½" shell, 25\tau W.P.

 -12,000 gal. Horizontal rubber lined Tank 10'\tau' x 17'4".

 1000 gal. S.S. Clad, Vertical Tanks.

 Langenskamp 6' x 5', 316 S.S. Vertical Tank

 Tank.
- -Langenskamp 6° x 5', 316 S.S. Vertical Tank.
 -Langenskamp 600 gal., 304 S.S. agitated Tanks with coils.
 -5' x 6'' dia. x 16' long, 304 S.S. Horizontal Tank, 3000 gals.
 -Steel Storage Tanks 8½' x 25', 8' x 16', 6' x 20',
 -Swenson-Walker 30; 304 S.S. Continuous Crystallizer.

HEAT EXCHANGERS

- -1655 sq. ft., 304 S.S. tubes, 75 psi.
 -1300 sq. ft., Admirally Tube, 75 psi.
 -1200 sq. ft., 304 S.S. tubes, 150 psi.
 -1200 sq. ft., 304 S.S. tubes, 60 psi.
 -570 sq. ft., 304 S.S. tubes, 60 psi.
 -536 sq. ft., 304 S.S. tubes, 60 psi.
 -315 sq. ft., 316 S.S. tubes, 250 psi.
 -250 sq. ft., 316 S.S. tubes, 250 psi.
 -14, 20, 28 6 48 sq. ft., 304 6 316 S.S. tubes.

- 22-11—Karbate 24.6 sq.ft., tubular. 2—Karbate 188 sq. ft., tubular.

PULVERIZERS—CRUSHERS

- 1—Dixie #3620 non-clog Hammermill.
 4—NEW Jeffrey Hammermills 20" x 12", 15' x 18".
 6—Hardinge Mills 4½' x 16", 5' x 22", 5' x 36", 6' x 22", 8' x 48", 10' x 48".
 1—International 6' x 7 porcelain lined Pebble Mills.
 1—Patterson 6' x 8', 5' x 6', 3' x 4' brick lined Pebble Mills.
 1—Devine 5' x 10' steel jacketed Ball Mill.
 1—National 6" x 12" Mill, Two Roll.
 1—Kent 6" x 14" Three Roll, High Speed Mill.
 3—Gayco Air Separators 16", 4", 18"

- Mill.
 —Gayco Air Separators 16', 6', 18''.
 —Mikro Pulverizers, Bantam, #15H #2DH.
 #2TH.
 —Bail & Jewell #1, #0 Rotary Cutters.

SCREENS

- -#34 Robinson Triple Deck 30" x 104", -#42 Rotex Double Deck 40" x 84", -#421 Rotex single deck 60" x 84", -Robinson single deck 40" x 84", 304 S.S. -Patterson single deck 40" x 84", 304 S.S. -Tyler Hummer single deck 3" x 5", 3" x 10", 3" x 15" with Thermionic Units.

MIXERS

- Baker Perkins #15USE, ALL STAINLESS
 Double Arm, jacketed, Vacuum.
 Baker Perkins #15VUMM, 100 gal, jacketed, 100 HP.
 Baker Perkins #17DAM, 200 gal, jacketed, Sigma Blades.
 Baker Perkins 100 gal., 304 S.S. Sigma Blades.
 Day "Cincinnatus" double arm 250 and 100 gal.
- Blades.
 -Day "Cincinnatus" double arm 250 and 100 gals.
 -Patterson 6' dia. Steel Conical, 15 HP
- motor. 5—Steel, jacketed, Powder 50, 225 and 350 cu. ft.
- cu. ft. 1—4' dia., 304 S.S. Conical, 3 HP motor. 1—Eppenbach 1 HP, 304 S.S. Homo Mixer.

MISCELLANEOUS

- 3-25 Ton Freon Refrigerating Units.
 7-Stokes DD2, DS3, D3, B2, "R" & "F"
 Tablet Presses.
 10-Hash Vacuum Pumps H7, H6, H5, L5,
 H4, T87, #4, #2, AL-872.
 2-Stokes #4126, 4128 Vacuum Pumps,
 motor driven.
 8-Williey 4" Haveg lined Centrifugal
 Pumps, motor driven.
 15-Chlorinet, Durimet and Duriron Centrifugal Pumps 1½" to 5".

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essors; 3 Twin Screw Jacketed Troughs; 28" x 28" x 20' long; screws cored for 100 PSIG Steam. ACCESSORIES: All necessary Pumps, Motors, Instruments, Wash Tanks.

Vapor Scrubbers and Explosion Proof Motors.

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- Stainless Steel Hor. Pressure Tanks; 6' x 30'; 6500 gal.
- 2 Stainless Steel Vert. Pressure Tanks; 10' x 6'; 5000 gal. Agitated.
- Stainless Steel Lined Pressure Tanks; 10,000 gal., 10' x 30'.

1 Stainless Steel Vacuum Still; 755 gal., coil heated; 4'6" x 6'. Blaw Knox Stainless Resin Autoclave 7'6" x 7'6"; Jktd. for Dowtherm. Lancaster Stainless Lined Rotary Reactor; 50" x 17'4"; 300 PSI ASME; Jktd. Ni Resist Reactor; 7' x 11'6"; Manhole Top; Jacketed & Agitated. Patterson Steel Jacketed, Agitated Reactor; 2300 gal., 88" x 90'. Pfaudler Glass Lined Jacketed Reactors; 500 gal. and 1000 gal. Bethelehem Cast Iron 2600 gal. Still; 7' x 7'6"; Coils in Shell; Agit. Bethlehem Sulphonation Pot; 1400 gal., Coils Cast in Wall.

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300 gal., 200 gal., and 100 gal. Units, Double Sigma Arms; double geared; some with Hydraulic Tilt; 40 Units in stock.

Double Arm Sigma Type Laboratory Mixer; 21/4 gal.; 11" x 10" x 8-3/"; jacketed. Baker Perkins Size 11 Heavy Duty Mixer 15 gal. Jktd. Dbl. Sigma Arms.

3 J. H. Day Brighton Mixers No. 2; 90 gal., Size 32" x 26" Sturtevant Whirlwind Centrifugal Air Separator; 5 HP with Vibrator & Fan.

2 F. J. Stokes Microvac Vacuum Pumps with 5 HP Motor.

6 Tolhurst 40" Suspended Rub. Covered Centrifugals; Monel Plow; 2 Sp. Motors. 8 Stainless Steel Heat Exchangers & Condensers up to 1000 sq. ft. surface.

Shriver 36" JACKETED Cast Iron Filter Press; Seco Closure.

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MIXERS—Cone 5/7 cu. ft.—Double Cone 16 cu. ft. (Pat. Kelly), Muller type EBG 3, EAG 3 (5 cu. ft.), EAG 4 (9 cu. ft.) (Laneaster), 14 cu. ft. Clearfield

SCREENS—3 x 5 (new) Universal, 3 x 10 Tyler Hummer 38 enclosed double, Rotex 40 x 84 & 40 x 120 (double), Robal 40 x 84 (double), 5 x 12 Robins (double)

40 x 120 (1803), houst 10 (1804), houst 10 (1804), houst 10 (1804), houst 11 (1804), houst

AUTOCLAVE—Stainless steel (gai. 1000 psi 150 psi xpi. proof gearmotor

MILLS—Hardinge Conical 4½ x 16", 7 x 22", 7 x 48" (pebble), 7 x 48" (bail) w/electric ear controls, full airswept accessories (new)

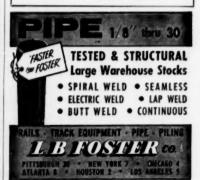
CRUSHERS—Jaw 71/2 x 13, 20 x 4, 15 x 24, also primary 15 x 24 jaw w/portable secondary, roll/

CRUSHERS—Roll 30 x 16 Chambers, 42 x 18 Traylor AA, Single 24 x 24 Link Belt, 30 x 30 Joffrey

Jeffre LIFT TRUCKS—2008 # Hyster w/rebuilt engine, 5000 # Yale w/fluid drive, new Chrysler Engine & cab—both pneumatics. ROTARY DRYER—Stainless 50" x 20' w/primary/ secondary dust collectors, 5" Gayco & Baghouse, also 24" x 22", 36" x 20", 50" x 30".

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- 3-All stainless steel vacuum Shelf Dryers, 108 sq. ft.
- #27 Vacuum Shelf, 475 Devine sq. ft.
- #23 Vacuum Shelf, 356 Devine sq. ft.
- 2 Devino Vacuum Shelf Dryers, size 17. 80 ag, ft. UNUSED.
- St. St. Spray Dryer, 19' dia. x 20' high, with Western Precip. noz-1zles, fans, oil burner, etc.
- -American Double Drum Vacuum Dryer, 36" x 84".
- Double Drum Dryers: 42" x 120"; 42" x 100"; 32" x 52"; 24" x 60"; 22" x 38"
- Rotary Hot Air Dryers: 4'6" x 40'; 4'6" x 32'; 3' x 24'.

VULCAN ROTARY DRYER-6' x 60'

- Rotary Coolers: 104" x 30': 104" x 70': 5' x 40'.
- B & S Rotary Hot Air Dryer, 3' x 15'. Everdur (Silicon Bronze)
- Stokes Jacketed Rotary Vacuum Dryer, 3' x 10', 3' x 15'. Rotary Steam Tube Dryers: Louis-ville 6' x 40' and Bryers Coles 4' x 30'.
- Davenport size 2A Dewatering Presses.
- Swensen Walker Crystallizers steel, jacketed, each 30' long.

EVAPORATORS—STILLS

- Ozark-Mahoning Submerged Combustion Evaporator, type 316 stainless steel, 2.800.000 BTU/Hr.
- 2-Bartlett Snow, St. St. Jacketed Evaporating Kettles 6' dia. x 3' deep with heavy duty agitator and 25 HP 4 speed drive
- Conkey 1.900 sq. ft. Triple Effect. Evaporator Vertical long Herculoy
- Buflovak size 6.5 model 629D Double Effect, all stainless steel, 588 sq. ft.
- Stainless Steel Dairy type 6' dia. Vacuum Pan with Coils.
- Struthers-Wells Single Eff. St. St. 625 sq. ft. vertical tubes.
- Stainless Steel 145 sq. ft. coil, 500
- 150 gal. Jacketed Vacuum Pan St. St.
- Stokes type 316 St. St. Double effect water still, 250 GPH. Copper Bubble Cap Distillation Col-
- umns 24" dia. to 48" dia. Stainless Steel Packed type Columns 8" dia. to 24' dia.

CENTRIFUGALS

- 1-AT&M Susp. 48" dia. Perf. Basket. St. St. Fume tight.
- -Fletcher Susp. 40" dia. Basket, 1 perf. plain steel. I rubber covered imperi.
- Fletcher 12" dia. St. St. Solid Basket.
- 3-Bird 24" x 38 monel, Solid Bowl.
 - Bird 32 x 50 Solid Bowl Centrifugals. Type 316 Stainless Steel, fume-tight, 60 HP motor. Built
- Bird 36" x 50" Solid Bowl, Steel.
- Bird 40" x 60" Solid Bowl, T304 S. S.
- DeLval Nos. 74-11: 94-01 600.
- DeLaval #BUH-3930 Hermetic Clarifiers, Stginless Steel.
- Sharples C-20 Super-D-Hydrator, T316 St. St.
- Sharples 16-V, Separator type bowl. T304 St. St.

PATTERSON—5' x 22' CONTINUOUS BALL TUBE MILL, 200 HP MOTOR, UNUSED.

NIAGARA MODEL 510-28 FILTER. T316 ST. ST., 510 SQ. FT.

OLIVER 5'3" DIA. x 8' FACE ROTARY VACUUM FILTER, PRE-COAT TYPE, STEEL, UNUSED.

FILTERS

- -Sparkler #33-S-28 Filters, Steel Tank, St. St. plates.
- 1-Feinc 6'6" D x 6' Face String Discharge.
- 2-Eimco 10' x 12' Rubber Covered Filter.
- Sweetland Filters: #12 (12 lvs.); #5 (20 lvs.).
- -Cast Iron Filter Presses, 30" x 30" open delivery, 28, 35 and 50 cham-
- -Filter Presses, closed delivery, 7"-36"
- Louisville 36" wide 8-roll Continuous Filters.

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MIXERS—BLENDERS

- Gemco St. St. 30 cu. ft. 54" dia., iktd. Conical Biender.
- 1-Conical Blender, Steel, 6' dia.
- 3-Sprout Waldron size 12 Ribbon Mixers. 336 cu. ft. work. cap.
- 5-Stainless Steel Sigma Blade double arm jacketed mixers. 5 gal., 10 gal., 50 gal. & 75 gal.
- 4—Sigma Blade Double Arm Jacketed Mixers, 21/4 gal., 50 gal. & 100 gal.
- 1-Robinson 110 gal. St. Clad jktd. Single Arm mass Mixer.
- 2-2.000 gal. Horis. jktd. Paddle Mixers.
- 3—Falk Vertical Agitator Drives #10-GDX, 10:1 300 HP—UNUSED.
- 5-Turbo Vertical Drives, #5B, 5:1, 40

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New in 1951-Expl. Pr. Motors

- 1-KACR Reactor, ser. #3127
- 1 Kom-Bi-Nator, 200 GPH, #3114
- 2-Roto-Feed Mixers, #3129, 3130
- 1-AC-500 Homogenizer, #3125
- 1-DP-Dry Proportioner, #3131

TANKS

- 2-Aluminum 18.000 & 24.500 gal.
- 10-Aluminum, 500 gal. 80# WP.
- 10-St. St. Pressure Tanks-to 500 gal.
- 20-St. St. Storage Tanks-to 1000 gal.
- 1-St. St. Oval Tank. 2500 gal.
- 1-3,500 gal. St. St. Tank on trailer.
- 1-600 gal. T313, 1/4", ASME 15#.
- 1-3000 ggi. St. Clad Vertical Vacuum Tank with coils.
- 27-Vert. Welded Steel Tanks, dished heads, 7500 gal.

AUTOCLAVES—REACTORS

- 465 ggl. St. St. 3' dig. 8'6" deep. 150# WP. 165# jkt. pr.
- Plaudler Glass Lined, jktd. & agit. 30 gal., 50 gal. & 100 gal.
- 3-St. St. T347 13 ggl. 1400# test. 50# ikt.

Equips bought & sold





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C20 Sharples Super-D-Hydrator SS. 26" AT&M Susp. Perf. Centrifuge SS. 36" & 50" Bird Cent. Centrifuge. 40" 55 Bird Sus. Perf. Centrifuge. Rotoclone Collector Size 36, Type W 4'x40'x1-1/16" Steel Column, 470 PSI. 3500 Condenser Admir. 125 PSI. 13500 sq. ft. Condenser Admir. Tubes. x 20' x 1/4" Rotary Cooler. x 40' Louisville Rotary Cooler (2). 502-16 L.B. Roto Louvre Dryer. 705-20 L.B. Roto Louvre Dryer, S.S. 705-24 L.B. Roto Louvre Dryer. 3' x 15' ft. Stokes 598 Rot. Vac. Dryer. 8' x 125' x ¾" Kiln. #2 Sweetland Filter Cast Monel. #10 Sweetland Filter 36-3" leaves.

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| STOKES
MD. | RB2 | TABLET | MACHINE, |

7' x 18' Patterson Ball Mill 2 Comp. Fitzpatrick Comminuter \$5, $7\frac{1}{2}$ HP, XP. Jeffrey Hammermills, 15×8 , 20×12 . 3620 DIXIE-Non Clog Hammermill. Mikro Pulverizers 2TH & 1 W. Case Packer-Std. Knapp 6/1 gal. cons. 412G Stokes Microvac (NEW). 300 gal. S.S. Jktd. & Agit. Reactor, New. 30" Robinson Rotery Cutter, 30 HP. 40" x 84" Rotex #41 Single Deck. 60" x 84" Single Deck Rotex Screen. Gyro-Sifter Low Head 7 screens, 1 HP. 4500 gal. Hortonsphere. 2500 gal. Rubber Lined Tank, 6' x 11'. Merrick Weightometer.

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- 2800 Gal. Horizontal T-304
- 2000 Gal. Vertical T-304
- 1000 Gal. Vertical T-304 675 Gal. Vertical T-304
- 500 Gal. Vertical T-304

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Centrifugals: Fletcher 12" copper.
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Tolhurst 24" rubber covered.
Centrifuge: Inter. size 3 mod. FS. 2 hp.
Clarifiers: De Laval 84-51, SVKSR, 04-21.
De Laval #800 multiple.
Condenser: stainless stail and

De Laval #800 multiple.
Condensers: stainless steel and copper.
Conveyors: screw; Hammond 16" st. steel.
Dryers: Devine 2 x 4' vac. drum st. steel.
Bowen laboratory Bpray type.
Ruggles Coles XA 4 x 26' rotary.
Double drum atmospheric to 120".
Rotary Vacuum 21/2 x 8".
Louisville Davenport Steam Tube.
Mordyke rotary steam 120 bu/hr.
Evaporators: Swenson triple effect 350 sq.
ft. single effect 350 ft.
Molonnier st. steel, 382 sq. ft.
Fillers: for liquid, paste, powder.

Mojonnier st. steel, 392 sq. ft.
Fillers: for liquid, paste, powder.
Fillers: Oliver 2½ x 1', Sparkler, Alsop,
Lomax, Industrial.
Oliver 3.5 sq. ft. monel horizontal.
Eimco 4x3 steel drum, unused.
Oliver 6x4 s. s. drum with flapper.
Filter Presses: Sperry, Shriver 6" to 36".
Keitles: Stainless steel 20 to 150 gal. with
and without agitators.
Dopp 150 gal. dbl. st. agitator.

Mills: Pebble, Abbe #5, 36 gal.
Pebble: 5' dia., 6\footnote{12} ig., buhrstone lined.
Mikro: No. ISH Bantam and 24".
Hammer: Jeffrey 30 x 24" type A.
Hammer: Williams sixe BX type AK.
Raymond: 0000 IMP, 16" screen mill.
3-roll: Ross 12 x 30". Day 12 x 32".
Colloid: Charlotte iron, 25 hp.
Colloid: Charlotte model 20, st. st., 20 hp.
Fitspatrick model D, st. st., 5 hp.
Mixers: Dbl. and sgl. arm sigma blade.
Jacketed horiz. 550 gal. st. steel.
Dry Powder: 1\footnote{12} to 77 cu. ft.
Day powder, copper body, 140 cu. ft.
Liquid tank to 500 gal.
Muller: Simpson st. st. bowl 39x20".
Pony: Day 40 gal., Ross 20 gal.
Genco st. st. Tumbler, 7\footnote{12} hp.
Press: Louisville dewatering 10x22" rolls.
Pumps: Centritugal, rotary, gear, vacuum.
In various sises and metals.
Reactor: VanAlst st. steel 18 x 50".
Separators: DeLaval AC-VO Noxie-Matic.
Sterilizers: American 42 x 52" x 11\footnote{12} ig.
Stills: st. steel 24 x 45", 24 x 32", 20 x 24".
Tablet Machines: Single punch and rotary.
Tanks: Stiln. steel various sixes.

Tablet Machines: Single punch and rotary. Tanks: Stain. steel various sizes. Glass lined to 500 gal. cap.

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135 PS1 8x9 Ing. ES1
135 PS1 8x9 Ing. ES1
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125 PS1 IOx11 Worth HB
125 PS1 IOx12 Worth HB
100 PS1 I3-8x12 Ing. XRB
100 PS1 I3-8x1 Ing. RB1
100 PS1 I3-18x1 Ing. PRE

CEM

American

AIR COMPRESSOR CORP NORTH BERGEN N Telephone UNion 5.4848

FOR SALE 1000 FT. 14" LP.S. SCH. 40
PRIME STAINLESS STEEL PIPE WELDED

TYPE 304 ELC IN 10 FT. LENGTHS WRITE FOR OUR STOCK LIST #436 STAINLESS STEEL SALES CORP.
500 N. 12TH ST. PHILA. 23, PA.
TELEPHONE: MARKET 7-5850 Premier 6" and 10" COLLOID MILLS Abbe 1½ gal. and 200 gal. DISPERSAL MIXERS

Sharples type M-12-161 H CENTRIFUGE STAINLESS STEEL rectangular tank 1500 gal.

STAINLESS STEEL jacketed kettles 100

gal. and 55 gal. at 90 psi.
Day #2 Cincinnatus DOUGH MIXER

20 gal. W & P lab DOUGH MIXER 1 gal.

IRVING BARCAN CO.

249-51 Orient Ave Jersey City 5, N. J. DElaware 2-6695-6

FOR SALE

- 3-UNUSED Plaudier 60 gal. Evaporating Dishes.
- Day 350 gal, sigma blade STAIN-LESS STEEL MIXER.
- Fletcher 48" Whirlwind Extractor, Stainless Steel basket.
- 3—Sparkler RUBBER COVERED Filters. 8". 12". 33".

The Machinery & Equipment Corp. 293 Frelinghuysen Ave.

STEAM GENERATORS

121,650 lbs. 60,000 lbs. 55,000 lbs. Steam delivered per hour

All new, never used, never completely assembled, Navy Surplus, High Pressure Boilers 121,650 Faster Wheeler, double furnace, single uptake, 365 psi max, rated working pressure, 850 deg. F. max, steam temp., 7 oil burners, soot blowers, economizer, superheater. 60,000 Foster Wheeler, 2 drum, 435 psi operating pressure, 740 deg. F. max. steam temp., 3 cil burners, soat blowers, economizers, superheaters, valves and fittings. 55,000 Wickes, 3 drum, 248 psi max. rated working pressure, 3 oil burners

PELNIK-LOCONTI INDUSTRIAL SUPPLY CO.

Office Ph. Utica 6-4621

315 Oriskany Street, Yorkville, N. Y.

Yard Ph. Utica 2-4513

IF YOU PONDER ON PRODUCTION COSTS give serious consideration PROCESSING EOUI

- 1-Feinc Stainless Steel Rotary String Filter, 3'x3' (NEW)
- 3-3000 gal. Stainless Steel Vertical Tanks
- 2-Stokes Stainless Steel Jacketed Vacuum Dry-
- Komarek-Greaves Briquetting Machine, with 50 HP motor.

AUTOCLAVES, KETTLES AND TANKS:

- -250 gallon Stainless Steel Jacketed Reactor
- -Vertical Rubber-lined Storage Tanks, 1000 gal. (New)
- Stainless Steel Vertical Storage Tank, 9000 gallons
- -Van Alst Stainless Steel Jacketed Kettle, 600 gallons -Struthers Wells Type 347 Stainless Steel Autoclave, 1000 gallons, 2000# pressure
- Plaudler 500 gallon, Series R, Glass-lined Jacketed Reactor
- Glascote 10 gallon Glass-lined Jacketed Kettle, 175 PSI Internal 150 PSI Jacket
- Pfaudier Glass-lined Vacuum Receivers, 30, 50 and 100 gallons
- Chicago Bridge & Iron Works, 17,000 gal. Pressure Tank, 80 PSI

DRYERS & KILNS:

- 1—Link Beit Stainless Steel Roto Louvre Dryer, Model 207-14 1—Buflovak Double Drum Dryer, 42" x 120", ASME Code 1—Stokes Double Drum Dryer, 5' x 12', complete, ASME

DRYERS & KILNS:

- -Hardinge Rotary Dryer, 5' x 50' -Hardinge Rotary Dryer, 7'8" x 55' -Bartlett & Snow Rotary Dryer, 4'6" x 36'6" -Link Belt Steel Roto Louvre Dryers, Models 207-10, 310-16
- and 502-20 Stokes Single Door Vacuum Shelf Dryers. 4 and 6 shelves

CENTRIFUGALS:

- 1-AT&M Stainless Steel Suspended Type Centrifuge, 46" Imperforate Basket
- Sharples Type 316 Stainless Steel Centrifugals, Model D-2
- AT&M Stainless Steel Suspended Type Centrifuge with 18" periorate basket, complete
- Tolhurst Suspended Type Centrifuges with 32" Imperforate Baskets, complete
- Sharples Stainless Steel Super-Pressurite Centrifuges, Model
- 1-DeLaval Type 316 Stainless Steel Multimatic Centrifuge

FILTERS.

- 3-Niagara Stainless Steel Fitlers, Model 510-28, 200-36 and 36H-60-4
- Bird Continuous Centrifugal Filter, 24" x 38"
- Sweetland #7 Filter with 20 leaves
- 10-Sweetland #12 Filters with 72 Stainless Steel leaves



- -Oliver Rotary Vacuum Filter, Rubber-lined, 3' x 6' -Impco Rotary Vacuum Filters, Iron, 5' x 4', complete

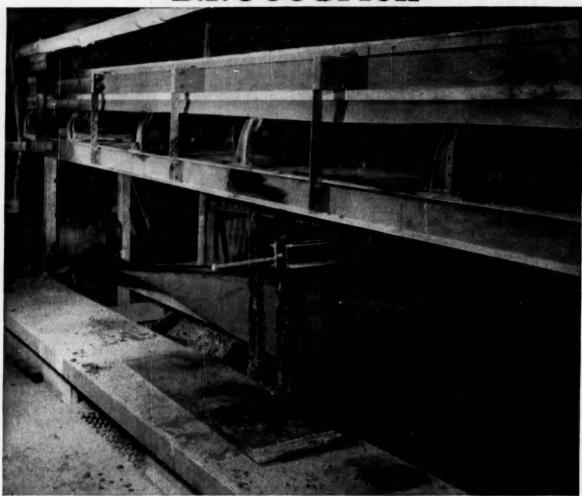
MISCELLANEOUS:

- 1-J. H. Day Stainless Steel Double Arm Sigma Blade Mixer, 50
- Vulcan Type 316 Stainless Steel Bubble Cap Column, 3' x 41'. with 30 trays
- Davis Eng. Type 347 Heat Exchangers, 120 sq. ft. (New) Davis Eng. Type 347 Heat Exchangers, 200 sq. ft. (New)

- Ross Steel Heat Exchangers, 1000 sq. ft. ea. Stokes Model DDS2 Rotary Tablet Machine, complete
- Stokes Model F Tablet Machines
- Foster Wheeler Dowtherm Unit, 600,000 BTU
- Vulcan Steel Bubble Cap Column, 42" x 30', 20 trays, ASME (New)
- Vulcan Steel Bubble Cap Column, 18" x 25', 18 trays, ASME (New)
- 1-Abbe Engineering Buhrstone-lined Ball Mill. 500 gal. Complete
- 1—Baker Perkins Ter Meer Type 316 Stainless Steel Centrifugal, Model HS-24
- Stokes Stainless Steel Jacketed Vacuum Dryer, 6'x10'
- 1—F. L. Smidth Rotary Kiln, 8'2"x132' 4—Rotary Dryers, 6'2"x45'
- 1-Buflovak Stainless Steel Jacketed Vacuum Reactor, 250 gallons.

CHEMICAL, RUBBER, OIL, PLASTIC and FOOD PROCESSING MACHINERY U.S.HIGHWAY No.22, UNION, N.J. MUrdock 6-4900

B.F.Goodrich



How to handle sticky chemicals without damage to conveyor

THAT belt carries triple superphosphate, a hot, sticky, abrasive chemical that's made into fertilizer. Handling the stuff with a regular conveyor used to be a terrific problem. Sticky particles would cling to the belt, build up into gummy layers, clog the return idlers, damaging the belt cover.

Then a B. F. Goodrich distributor recommended something quite different in conveyors—the B. F. Goodrich "turnover" belt system. Here's how it works. As the material is dumped off the end of the moving belt, the belt makes a 180° turn, (as shown in the picture), runs empty along the return

idlers, then makes another one-half turn before receiving the next load.

Only the clean side of the belt touches the idlers, so there's no chance for sticky materials to build up on them. Danger of belt damage is reduced because lumps of materials cannot be trapped between the belt and pulleys. At the chemical company shown in the picture, engineers predict they'll get three times more service from the belt on the "turnover" system.

If you have an operation where sticky, corrosive materials must be moved from place to place, the B. F. Goodrich "turnover" conveyor system may be

the answer. Let a B. F. Goodrich distributor give you full details and show you how easy it is to convert a conventional conveyor into the turnover type. B. F. Goodrich Industrial Products Company, Dept. M-106. Akron 18, Ohio.



July 1957—CHEMICAL ENGINEERING

Nothing Cuckoo about this clock!

You may not need clock drives, but time (production time) is a problem everywhere—and that calls for the most dependable, most efficient use of electric drives—like here! This clock, with 300 lbs. of hands and four 24-foot dials is powered by a Master Gearmotor driving a precision gear train. With that accurate Master drive, here's a one-jewel clock!

Are you sure you've got the right answer to your drive requirements? Master components can be integrated in any combination to give you the right horsepower, right shaft speed, right mounting features, in a single, efficient, compact unit. Now's the time to let us prove it.



Features.

MASTER ELECTRIC



The 'works' of a tower clock, 15 H.P., 115/230 voit, 60 cycle, 1 phase Master Hight Angle Gearmotor supplies main drive with a synchronous output speed of 30 H.P.M.

ANOTHER DRIVE REQUIREMENT MEETS ITS

Motor Ratings......1/8 to 400 H.P. All phases, voltages, frequencies.

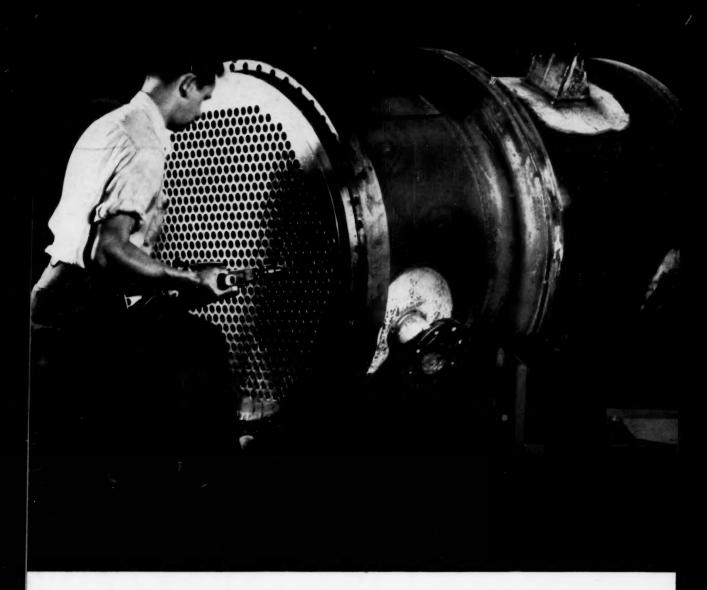
Motor Types.......Squirrel cage, slip ring, synchronous, repulsion-start induction, capacitor, direct current.

Construction......Open, enclosed, splash-proof, fan-cooled, explosion-proof, special purpose.

Electric brakes (2 types)—5 types of gear reduction up to 432 to 1 ratio. Mechanical and electronic variable speed units—fluid drives—every type of mounting.

THE MASTER ELECTRIC COMPANY
Dayton 1, Ohlo





Now you can get single- and double-pass heat exchangers in $\underline{two\ weeks'\ time}$

Speed of delivery—as well as versatility — enables you to use *standard* heat exchangers in place of higher-priced custom units. Now you can get a "flexible-standard" unit—in only two weeks' time.

The flexibility provided by Pfaudler's pre-stocked stainless steel exchangers puts an end to many of your designing and estimating problems. Both single- and double-pass units are available (on a two-week delivery basis!) in a variety of sizes ranging from 56 to 316 square feet.

Each model can be delivered with either long or short bonnet. All bonnets are fabricated after receipt of your order, so you get the flexibility of either single- or double-pass design.

These "flexible-standard" units are adaptable to vertical, inclined, or horizontal installation. Actually, they offer you many of the features you probably look for in custom-built heat exchangers.

One way to minimize your costs is to check with Pfaudler before you set out to install that "custom" unit. Pfaudler's "flexible-standards" and two-week delivery point the way to substantial savings.

Contact your Pfaudler representative for more complete information. Or, if you prefer, write direct and ask for Bulletin 837.

THE PFAUDLER CO.
ROCHESTER 3, N. Y.



Specialists in Corrosioneering

See pages 48 and 49 of this issue also.